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CENTRAL NEW YORK BEAVER DAMAGE TOLERANCE STUDY

by

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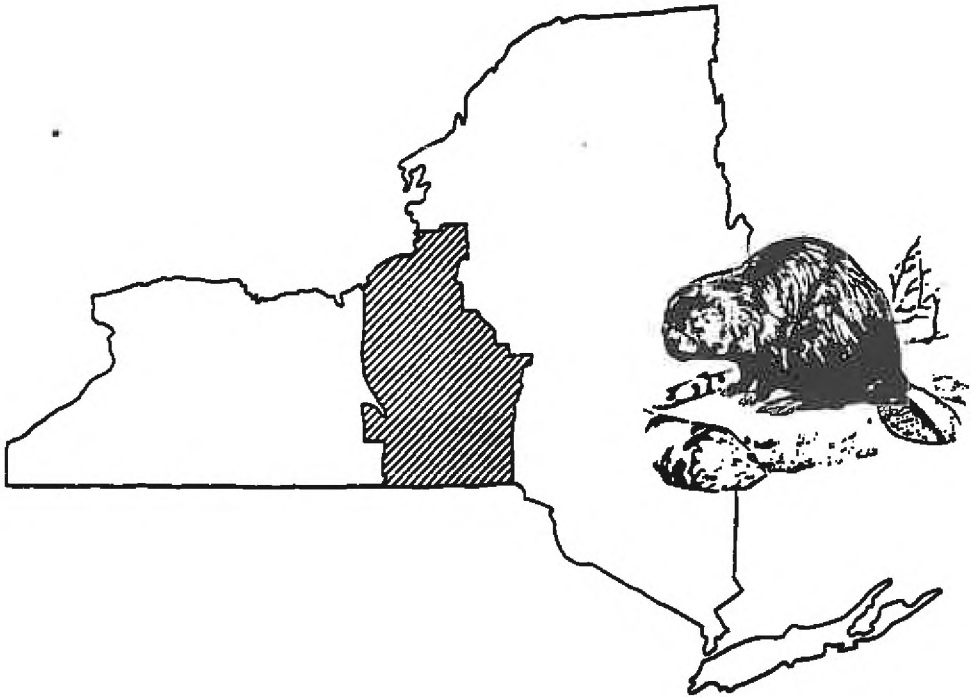

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EXECUTIVE SUMMARY

INTRODUCTION

Understanding landowner tolerance of wildlife damage has been an important element in efforts by the New York State Department of Environmental Conservation (DEC) to develop management plans sensitive to public needs and concerns. Little information, however, has been available to DEC regarding landowners' damage tolerance of New York's beaver (Castor canadensis) population.

Within most parts of New York, beaver populations are managed at levels to maintain an occupancy rate of about 30% of the potential sites that beaver may inhabit. This rate of occupancy is considered generally to be near the biological carrying capacity of the habitat. In central New York, however, managers have been reluctant to maintain populations at carrying capacity in all areas. In Wildlife Management Unit (WMU) 10 of DEC Region 7 site occupancy is currently maintained at a rate of about 10%; other WMU's within the region have maintained populations close to the desired 30% occupancy. The feasibility of increasing population levels in WMU 10 is questioned by DEC because of a perceived potential for significant management problems related to increased numbers of damage complaints. In response to this concern, a cooperative research effort by the Department of Natural Resources at Cornell University, the USFWS New York Cooperative Fish and Wildlife Research Unit, and Bureau of Wildlife staff of DEC Region 7 was undertaken to determine landowner attitudes about and tolerances of beaver activities in central New York.

Because highway superintendents contribute substantially to the number of beaver complaints in Region 7, DEC was also interested in the beaver-related attitudes and damage tolerances of these individuals. Therefore, in conjunction with the landowner study, a survey of county and town highway superintendents was developed.

The objectives of the study were to:

1. Determine preferences for future beaver population trends in Region 7.

2. Assess perceptions of the quantity and impacts of beaver damage incurred.

3. Determine the primary factors that affect tolerance of beaver damage (e.g., land use, previous damage experience, etc.).

4. Determine the types of beaver damage problems likely associated with an increase in beaver numbers and those problems least tolerable.

5. Estimate the probable frequency of beaver complaints associated with increasing beaver populations.

STUDY METHODS

Properties with beaver sites in Region 7 were identified by using DEC beaver habitat maps developed from 1983 aerial surveys of potential beaver colony sites and were stratified according to the nature of the site located thereon. Three strata were thus identified for sampling purposes: (1) active sites that had generated complaints (active/complaint sites), (2) active beaver sites that had not generated complaints (active/noncomplaint sites), and (3) sites without beaver activity (inactive sites). While sampling originally was intended to allow geographic stratification at the WMU level, insufficient numbers of beaver site-types within each WMU dictated a survey design regional in scope.

The names and addresses of landowners (henceforth termed "site-owners") with beaver sites identified on the beaver habitat maps were obtained through the use of DEC Division of Regulatory Affairs wetland landowner listings, New York county property tax records, and 1982-1983 Region 7 beaver damage complaint records. The systematically-selected sample resulted in a total initial sample size of 679. Site-owners were surveyed by mail questionnaire during January-February 1985.

An abbreviated mail questionnaire was sent to all county and town highway superintendents in Region 7. A total of 149 superintendents were included in that survey.

FINDINGS AND ANALYSIS

PART 1:

COUNTY AND HIGHWAY SUPERINTENDENTS

The initial sample size of 149 resulted in 0 nondeliverable and 126 (85% of deliverables) returned questionnaires.

Recent Beaver Damage

Within the 3-year period of 1982-1984, slightly less than one-half of the highway superintendents in Region 7 experienced job-related problems associated with annual beaver damage; 52% indicated that at no locations in their jurisdiction were roads or other structures damaged by beaver in an "average year." Region-wide, the number of beaver damage locations reported by superintendents averaged less than 2.

Among the types of damage typically encountered, damage to drainage culverts (i.e., obstructed by debris) was experienced most frequently (48%). Road surface erosion due to flooding from beaver activities was second in occurrence. A majority (58%) of the superintendents believed that culvert damage was their most important problem overall while 38% believed road surface damage was most important. Each incidence of culvert damage repaired by highway crews was estimated by superintendents to require an average of nearly 20 man-days of effort and repair costs, including labor, averaged about $2,200. Superintendents' estimated total cost for all beaver damage repairs in Region 7 during the period 1982-1984 was about $81,000. Nevertheless, only 1 of the 126 superintendents indicated that part of their annual budget was earmarked for dealing with such damage.

Damage Prevention Efforts and DEC Assistance Desired

Most superintendents with beaver damage reported taking some type of action to prevent damage from recurring, although in many cases that action consisted of requesting DEC assistance. In only 3 of the 9 counties responding did superintendents indicate that a schedule of regular maintenance of problem sites was used to prevent damage. Individuals receiving technical damage control information experienced among the lowest levels of damage, perhaps due to the use of such information. As superintendents were faced with increasing numbers of damage sites, they were less likely to attempt control of the problem on their own. Instead, they looked to DEC for assistance.

Seventy-two percent of the superintendents who contacted DEC for beaver control information also reported regular maintenance of likely beaver problem areas, thus indicating that the information obtained was incorporated into maintenance practices. Few superintendents (17%) who obtained a beaver removal permit actually removed the beaver themselves; more commonly they engaged others to remove the beaver.

Most (58%) superintendents who had contacted DEC regarding beaver damage reported satisfaction with the assistance received. The majority (58%) of dissatisfied superintendents cited "no response" as their reason for lack of satisfaction. Because DEC policy mandates that all wildlife damage requests be acted on within a period of 5 days from receipt at the regional office, it would therefore appear that many requests by superintendents were not reaching the regional office. This may account for the unexpectedly high percentage of superintendents reporting dissatisfaction due to a lack of response from DEC and may indicate a need for Region 7 staff to clarify communication channels with highway superintendents dealing with beaver damage.

Approximately two-fifths of all superintendents expressed no desire to obtain assistance from DEC regarding control of beaver damage. However, among those superintendents with beaver damage experience, 78% indicated that some type of assistance was preferred. In light of the findings that superintendents receiving technical information experienced among the lowest rates of beaver damage, DEC beaver damage control assistance programs for highway superintendents in Region 7 may be warranted.

Tolerance of Beaver Damage and Beaver Population Levels

Among all superintendents reporting beaver damage, 64% believed the recent level of damage to roads and other structures was generally tolerable. All superintendents were asked to provide their perception of the recent (i.e., 1982-1984) trend in the number of beaver related problems they dealt with in their jurisdiction. Only 5% believed the problems were decreasing while equal percentages perceived the problems to be either increasing (41%) or remaining stable (41%). Furthermore, superintendents did not appear to be receptive to an increase in the beaver population in Region 7. Only 12% indicated that a population increase would be preferred while about 45% wanted the population to decrease. Respondents with beaver damage experience were more likely to want a reduction in beaver numbers than those with no previous beaver damage. Those without damage experience preferred neither an increase nor a decrease; instead, most (60%) preferred the population to remain at current levels.

Superintendents' Experiences with Beaver as Property Owners and Beliefs Pertaining to Beaver

Efforts were made to determine if highway superintendents' attitudes toward beaver were affected by their experiences as private landowners. However, when asked if they currently owned property on which beaver activity

occurred, only about 2% answered affirmatively and 93% were certain that beaver were not located on their property. Nevertheless, many superintendents associated potential benefits with beaver-created wetlands.

Attitudinal differences were evaluated for superintendents indicating they were tolerant of beaver populations in their town versus those who were intolerant. While all respondents were somewhat positive in their attitudinal orientations toward beaver, statistically significant differences were noted between tolerant superintendents and intolerant superintendents, indicating that intolerant superintendents possessed less positive beliefs about beavers than did tolerant superintendents.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Town and county highway superintendents in Region 7 indicated a general reluctance to have beaver populations increase within their jurisdictions. Most, however, were willing to tolerate current beaver population numbers and associated levels of beaver-related road damage. The results of this study suggest that if the average number of damage locations that each superintendent deals with in an "average year" increases from the current number of somewhat less than 2 to 4 or more, increasing numbers of superintendents are likely to perceive beaver damage as intolerable and would prefer a decrease in the population. The probable result would be an increase in damage complaints filed by superintendents.

The manner in which superintendents' damage complaints and requests for DEC damage control assistance are communicated may be in need of agency clarification. Providing DEC field personnel and highway superintendents with information that clarifies the appropriate procedure for filing damage control requests is likely to increase superintendents' satisfaction with DEC response.

In light of the finding that nearly three-fourths of those who contacted DEC for technical damage control information appeared to apply that information by implementing a regimen of regular maintenance at likely problem areas, and that superintendents acquiring such information also reported among the lowest numbers of annual beaver damage locations throughout the region, we believe that a DEC program of regional provision of damage control information assistance may be warranted. Existing forums, such as the Annual School for Highway Superintendents conducted by the Cornell University Department of

Agriculture Engineering in conjunction with their Local Roads Program, may be among the most cost-effective outlets for a DEC program of this nature.

Under existing DEC policy, beaver damage complaints filed by highway superintendents have been answered with virtual "curb-service." Sending DEC personnel to the field to verify damage complaints or to assist with control measures may be costly. Encouragingly, the results of this survey suggest that alternative approaches may be effective in reducing both the numbers of damage sites experienced annually by superintendents and, correspondingly, the number of damage complaints they file with DEC.

PART 2:
SITE-OWNERS

Of the initial 679 questionnaires sent to site-owners, 129 (19%) were nondeliverable and 423 (77% of deliverable) were returned. Survey response rates among the 3 sampling strata (classified according to the nature of the beaver site located on the property) were as follows: active/complaint site-owners (85%), active/noncomplaint site-owners (76%), and inactive site-owners (69%).

Data Analysis Design: Use of a Tolerance Typology

Our original concept for data analysis consisted of site-owner tolerance evaluations based on comparisons of respondents in each of the sampling strata. A review of preliminary survey results, however, indicated that a reclassification of site-owners based on their beaver-related experiences and attitudes would be more suitable for providing insights for wildlife managers. The 4 site-owner types developed were (1) experienced, tolerant site-owners, (2) inexperienced, tolerant site-owners, (3) experienced, intolerant site-owners, and (4) inexperienced, intolerant site-owners.

This reclassification indicated that about two-thirds of all respondents expressed tolerance of current beaver populations regardless of their previous experience with beaver on their property. While the majority of respondents from complaint sites expressed intolerance, nearly 20% of these previous complainants were classified as tolerant site-owners. Among active/noncomplaint site-owners, nearly two-fifths reported intolerance. Yet, none of these individuals had filed a damage complaint with DEC during the time-period (1982-1984) involved in this study. A surprisingly large proportion

(44%) of individuals with sites classified by DEC as inactive were labelled "experienced", thus indicating they had observed evidence of beaver activity on their property during the three-year period. This discrepency may have been attributable to factors such as respondent misidentification of "evidence" of beaver activity and the three-year time period used as a referent in the questionnaire (during which a site may have been both active and inactive).

Characteristics of Site-owners and Their Properties

By and large, site-owners in Region 7 were permanent residents on rural properties. No evidence was found to indicate a difference in tolerance associated with the area in which the property was located or with duration of residence on the property.

Site-owners' properties averaged about 190 acres on which the most-frequently-occurring land-types were woodlands, homesites and ponds/wetland areas. The most-frequently-mentioned use of site-owners' properties as well as the single-most-important property use reported was use as a homesite. Intolerance of beaver activities was more commonly associated with persons who derived an income from their land use; site-owners with previous beaver experience were more than twice as likely to be intolerant than tolerant when their most important land use was perceived to be cash crop farming (20% vs. 8%) or timber production (16% vs. 4%).

Site-owner Perceptions of Beaver Activity

Approximately 53% of the site-owners responding to the survey indicated they had observed evidence of beaver activity on their property during the period of 1982-1984. Site-owners experiencing beaver activity on their properties reported that since 1983 about 10 acres of their property were flooded or covered with water due to beaver in an average year; an estimate close to the DEC value of about 12.5 acres as the average wetland size for active beaver sites in Region 7.

Perceived Quantity and Impact of Beaver Damage

Fifty-five percent of site-owners who were experienced with beaver (i.e., believing that beaver actually occupied the site) reported previous beaver damage or nuisance problems. Within the 3-year period 1982-84, the mean number

of years in which site-owners had damage was about 2 and, surprisingly, tolerant site- owners experienced no fewer years of damage than intolerant site-owners. Only about one-in-five of the site-owners reporting damage believed that damage to be severe. Furthermore, site-owners' tolerance of beaver decreased dramatically as their perception of beaver damage increased in severity. In fact, all persons perceiving severe damage were intolerant of beaver. Therefore, while tolerant site-owners may have received damage in as many years as intolerant site-owners, the former individuals generally perceived that damage to be less severe in degree.

Damage types, dollars-of-damage estimates, and site-owners' damage repair efforts. The type of damage resulting from beaver activity that was reported most frequently by Region 7 site-owners was damage to trees. Three types alone comprised about four-fifths of all damage reported; these were damage to trees (45%), flooding that resulted in soil erosion (21%), and damage to structures such as fencerows, outbuildings, drainage ditches and roads (17%).

Site-owners' estimates of the dollar value per incident of beaver damage experienced between 1982 and 1984 averaged about $700. Site-owners with crop damage provided the highest estimate at about $1500 per incident. Based on the average of 2 years in which damage occurred over the study period, and assuming 1 damage incident per year per site-owner, the annual property damage incurred per site-owner was about $465.

Considering all types of damage, the relationship between mean dollars of estimated damage and site-owners' tolerance attitudes suggested that intolerance of beaver was associated with considerably higher amounts of damage. We further explored this relationship by categorizing estimated dollars-of-damage and identified that category wherein the majority of respondents reporting damage changed from tolerant to intolerant. The results indicated that site-owners were willing to incur nearly $400 of damage per incidence and remain tolerant of beaver on their property. Nearly half (46%) of all damaged site-owners were in this estimate category. Combining this estimate with the average of about 2 years in which damage was experienced indicated that Region 7 site-owners were willing to tolerate about $800 of damage per person in return for the presence of beaver on their property from 1982 to 1984, or about $265 per year.

Site owners' mean expenses for repair/control per incidence of beaver damage was nearly $200; approximately one-fourth the amount of the estimated dollars-of-damage. Again, using the average of 2 years in which site-owners incurred damage over the 3-year study period, and assuming 1 damage incident per year per site-owner, the annual damage repair/control effort per site-owner cost about $120. The number of days allocated to repair/control efforts averaged 9. Consistent with earlier findings, tolerant site-owners spent fewer personal dollars and days for repair/control.

Estimates were developed of the fiscal requirements of an agency program designed to offset potential complainant site-owners' expenses for repair or control. Assuming the percentage of active sites from which beaver complaints emanate remains at 10%-15% annually, such a program would require at least $28,000 per year to maintain.

Actions Taken by Site-owners' to Control Beaver Damage and Satisfaction with DEC

Overall, only about 60% of those persons reporting damage took action to control the beaver damage. The majority of these respondents were intolerant site-owners. Among those individuals who attempted to control damage, allowing others to trap beaver at the site was the most frequent response.

Site-owners' satisfaction with DEC response to their beaver damage inquiries was mixed; only about one-half of those persons contacting DEC were satisfied with the response, regardless of the nature of the request. Two classes of responses comprised all reasons given for dissatisfaction -- no DEC response or action (74%) and insufficient response (26%). Recalling the aforementioned findings of a similar nature for highway superintendents, we suspect that similar causes may be attributed to dissatisfied site-owners' perceptions of inaction by DEC; many site-owners' requests for agency assistance may be communicated informally to DEC field personnel who, in turn, may not be relaying that request to the regional office. While that assumption may not be the sole cause for this problem, the finding does provide an indication that channels of communication for delivering beaver control requests to the regional office may be in need of review and clarification.

Estimation of Damage in WMU 10 Associated with an Increase in Beaver Populations

As mentioned previously, the beaver population of WMU 10 in Region 7 is currently maintained at a level to achieve about 10% site-occupancy, well below the 30% level achieved in other WMU's that is considered near carrying capacity. If the percent of active sites in WMU 10 were increased to 30% (n=673), the results of this study suggest that at least 1 site-owner on 55% (n=370) of those sites would, at some point during the year, believe they had incurred beaver damage and at least 55 beaver damage complaints may be expected annually. Furthermore, the average annual dollars-of-damage (approx. $465) resulting from beaver activity suggests that at 30% site occupancy, the damage incurred by site-owners in WMU 10 would total about $170,000 annually. This represents an increase of nearly $120,000 in damage over the level estimated at the current 9% site occupancy. Also on an annual basis, the personal expenses (approx. $120 per year) that site-owners would incur in repairing or controlling damage associated with a 30% occupancy rate was estimated at about $44,000, or an increase of $31,000 over current amounts.

Site-owners' Beaver Damage Control Concerns

Property affected. A slight majority (52%) of site-owners recognized, as expected, that, in the event of future beaver damage, ponds or other wetland areas were most likely to be affected. Woodlands (often in close proximity to wetland sites) were perceived as second most likely (47%) to receive damage. Among those with damage concerns, woodlands, ponds/wetlands and croplands were areas of the greatest control interest.

Willingness to implement beaver control actions. Given these concerns about controlling damage, site-owners were asked whether they were willing, if provided technical information, to "make their property less attractive" for beaver (i.e., beaver habitat modification) to prevent future damage problems. Slightly over one-half (54%) of all site owners responded affirmatively to this question. Among site-owners tolerant of beaver, only 33% of the experienced respondents and 45% of the inexperienced respondents appeared receptive to the notion of habitat modification. Conversely, no fewer than 80% of both experienced and inexperienced intolerant site-owners were willing to conduct habitat modifications.

Damage control information source preferences. Among the potential outlets of information available to assist site-owners' beaver control efforts,

2 sources each were preferred by over 50% of all respondents; county Cooperative Extension agents and DEC's magazine "The Conservationist." The 3 least-preferred sources among all site-owners were radio (14%), farm organizations (21%), and newspapers (23%). While those sources most preferred may be suitable for reaching a majority of site-owners, the data indicate that a multi-source approach would be optimal.

Site-owners' Attitudes and Beliefs About Beaver

A Wildlife Attitudes and Values Scale (WAVS) was employed to determine possible differences among site-owners in relation to their beliefs about beaver. Tolerant site-owners typically had more positive beliefs of an "appreciative" nature about beaver than did intolerant site-owners. In particular, tolerant site-owners were much more appreciative or supportive of the roles that beaver assume as indicators of environmental quality, as creators of wetland environments, and of their overall ecological role. The response distributions of tolerant and intolerant respondents to the belief regarding tolerance of beaver damage showed the acute opposition of opinions reflected elsewhere in this study; the proportions of tolerant respondents agreeing with the belief were nearly diametrically opposed to that of intolerant individuals who disagreed.

Attitudes related to wetland uses. The majority of all site-owners, especially those classified as tolerant, recognized many of the recreational benefits associated with the presence of beaver sites. While the opportunity for nature or wildlife observation was perceived by the single largest percentage (42%) of respondents as the type of use they were most likely to have, over one-fourth also suggested they valued sites for hunting and fishing uses.

Preferences for beaver population levels and perceptions of beaver abundance. A summary of the attitudes for the major groups of tolerant and intolerant site-owners follows:

> Tolerant site-owners -- This group of site-owners, both experienced and inexperienced with beaver, comprised about two-thirds of all respondents. While 71% of this group indicated that the presence of beaver on their own property was either enjoyable or did not matter to them personally, the remainder were worried about the possibility of damage. Nevertheless, all tolerant site-owners had the additional characteristic of believing that beaver populations should either be maintained at current levels (71%) or increased in size (29%).

Intolerant site-owners -- Individuals characterized by intolerant attitudes, regardless of their previous experience with beaver, comprised about one-third of all site-owners. While some (6%) did not strictly oppose the presence of beaver on their own property, most (70%) respondents classified as intolerant believed, nevertheless, that the beaver populations should be decreased in size. None preferred a population increase.

Overall, site-owners preferred beaver populations to remain at 1984 levels; nearly 60% wanted the population to remain at that level of abundance while site-owners preferring increases or decreases were represented equally at about 20% each.

DEC beaver survey data indicate that the recent abundance of beaver in Region 7 has generally been among the highest levels experienced in many years. Few site-owners, however, have perceived this increase; overall, only 30% reported a noticeable increase in beaver since about 1980 in the town in which their property was located.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

To date, most owners of beaver sites in Region 7 appear to be tolerant of the levels of beaver associated with the population increases that have been achieved in the Region. It is important for managers to note, however, that further population increases were not believed to be desirable among most site-owners; instead, current levels of beaver were preferred.

Until site-owners' tolerance of beaver within specific WMUs in Region 7 are better understood, managers should proceed cautiously with any plans to increase beaver in WMUs currently below carrying capacity. Nevertheless, we have demonstrated how DEC beaver survey data can be combined with findings from this study to assess more accurately than previously possible the numbers of site-owners who may incur damage and the number of complainants expected from a specific percentage increase in site occupancy by beaver. Managers' assessments of the resources required to handle the increase in complaints will continue to be a limiting factor to the potential for beaver population increases.

The results of this study have further provided estimates of the costs of beaver damage incurred by landowners, from both a property impact and damage repair/control perspective. Ethical questions arise from these findings: What responsibility does an agency have for the costs of property damage and

personal damage repair/control expenses incurred by landowners as a result of beaver management policies? To what extent should agencies mitigate those costs? While these questions must ultimately be resolved by decisionmakers, this study has provided findings that should prove useful to such considerations.

As a group, intolerant site-owners may be viewed as "high probability complainers" and are most in need of and receptive to DEC-supported damage control programs. Their previous experiences with beaver damage and past control efforts indicate they are strongly motivated to implement damage control measures in areas of most concern (these include woodlands, croplands, and existing ponds or wetland areas). Providing effective damage control information to intolerant site-owners should have the added benefit of reducing their perceived costs of damage and, concomitantly, the levels of intolerance (and complaint potential) among these individuals.

Additional research is needed to assess more precisely the impact of beaver control/damage mitigation measures on beaver tolerance attitudes, including perceptions of beaver damage costs. Efforts such as these would allow managers to select control methods for use in damage control programs that are most cost-effective from both an environmental and human tolerance perspective. The extent of damage control assistance provided by DEC to site-owners must also be considered. For each type of damage identified in this study for which control measures may be considered, it is clearly important that the costs associated with control do not exceed the costs of the beaver damage itself.

Consideration should also be given to alternative wetlands programs. Included among such programs are those that may involve agency promotion of the positive aspects of being an "owner" of wetlands and reducing the disencentives of maintaining beaver and wetlands by providing appropriate damage control information or assistance through innovative approaches such as "Wetlands Cooperator" programs.

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INTRODUCTION

Understanding landowner tolerance of wildlife damage has been an important element in efforts by the New York State Department of Environmental Conservation (DEC) to develop management plans sensitive to public needs and concerns. Considerable effort has been devoted previously to the subject of landowner attitudes toward wildlife damage in New York State. Studies by Brown et al. (1976, 1978, 1979) and Decker et al. (1981, 1982) have investigated feasibilities of deer management strategies in relation to farmers' willingness to tolerate deer damage to crops. Smolka et al. (1984) have provided other important insights into public tolerances of wildlife by evaluating attitudes toward bear populations in the Catskills and recent investigations by Decker and Gavin (1985) have addressed the economic and sociological conflicts resulting from the presence of deer in suburban areas of Long Island, New York. The information resulting from those surveys enabled population management plans to reflect human attitudes and tolerances toward those species more accurately than was previously possible.

Knowledge of landowners' damage tolerance is needed for the management of New York's beaver (Castor canadensis) population. Compared to most wildlife species within the State, the activities of beaver are likely to conflict with human land uses, a fact indicated by the number of beaver complaints filed annually by landowners. Current management plans are influenced strongly by wildlife managers' perceptions of landowner tolerance of beaver damage. To date, however, most beaver management studies conducted in New York have dealt with biological concerns (e.g., Parsons and Brown 1978, Ermer 1980, Gotie 1982), with little or no information being obtained to corroborate the accuracy of managers' perceptions of human tolerance. Therefore, to develop beaver management plans that accurately reflect human tolerance of beaver, DEC needed

information about the attitudes of individuals affected by changes in the distribution and abundance of beaver populations.

BACKGROUND

Beaver populations are a valuable resource to New York State. As a furbearing wildlife species they provide trapping enthusiasts with thousands of days of recreational activity statewide. From an economic perspective, the sale of beaver trapping supplies and beaver pelts generates millions of dollars of revenue, much of it returned to local economies throughout the State. Ecologically, beavers have profound affects on the environment. The wetlands created by their activities provide, among other benefits, flood and erosion control, groundwater recharge, and critical habitats for many kinds of fish and wildlife species. These benefits notwithstanding, the activities of beaver may also create damage problems that wildlife managers must attempt to mitigate by regulating population levels in relation to both biological and sociological constraints.

Within most parts of New York, beaver populations are managed at levels to maintain an occupancy rate of about 30% of the potential sites that beaver may inhabit. This rate of occupancy is considered generally to be near the biological carrying capacity of the habitat. In central New York, however, managers have been reluctant to maintain populations at carrying capacity in all areas. In Wildlife Management Unit (WMU) 10 of DEC Region 7 site occupancy is currently maintained at a rate of about 10%; other WMU's within the region have maintained populations close to the desired 30% occupancy (Figure 1). The feasibility of increasing population levels in WMU 10 is questioned by the DEC because of a perceived potential for significant management problems related to increased numbers of damage complaints (J. Proud, DEC, pers. comm., 7 June 1984). In response to this concern, a cooperative research effort by the Department of Natural Resources at Cornell University, the USFWS New York

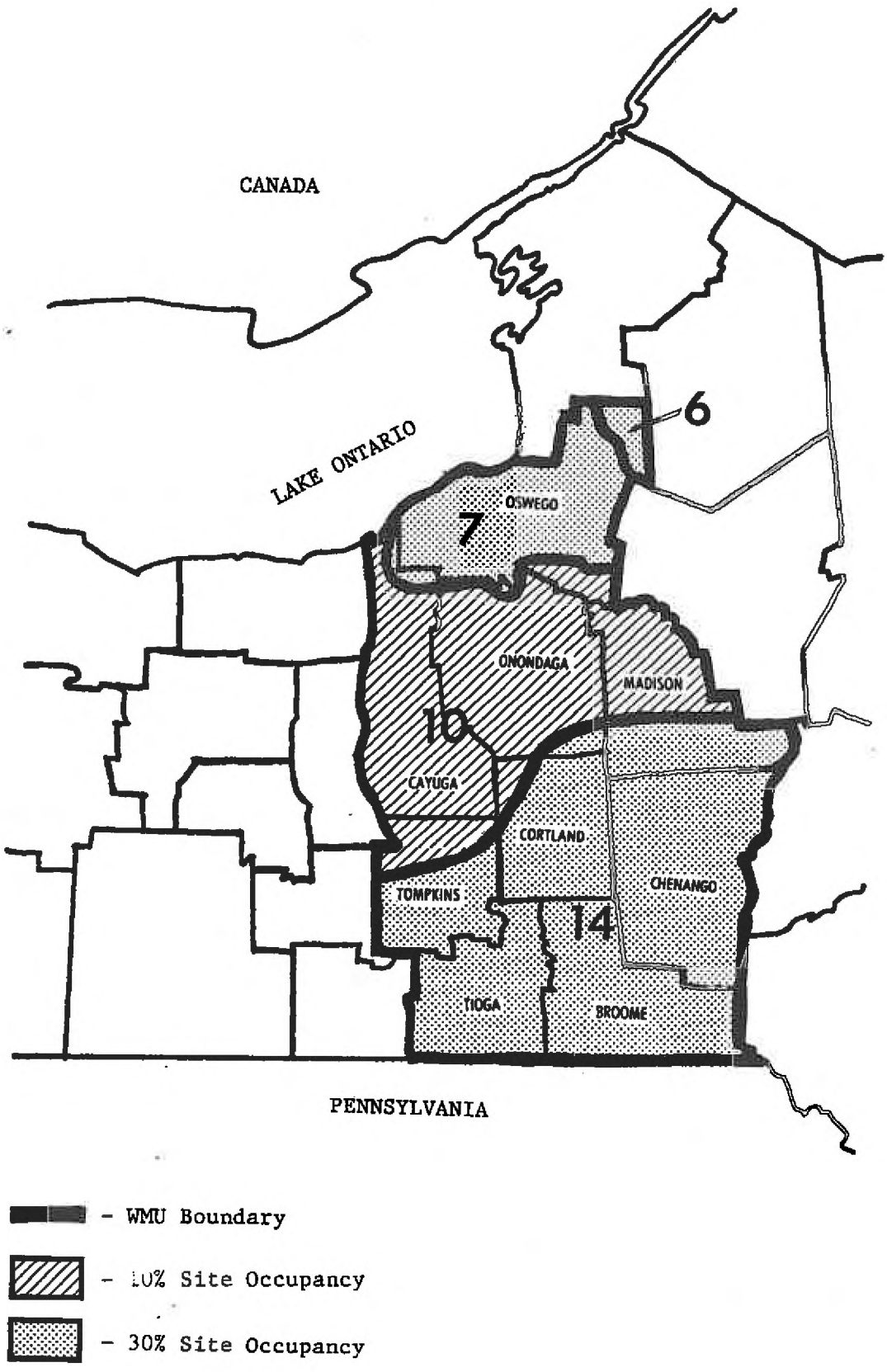


Figure 1. 1983 Beaver Site Occupancy Rates in Wildlife Management Units (WMU's) of DEC Region 7.

Cooperative Fish and Wildlife Research Unit, and Bureau of Wildlife staff of DEC Region 7 was undertaken to determine landowner attitudes about and tolerances of beaver activities in central New York.

The objectives of the study were to:

1. Determine landowner preferences for future beaver population trends in Region 7.

2. Assess landowner perceptions of the quantity and impacts of beaver damage incurred.

3. Determine the primary factors that affect landowner tolerance of beaver damage (e.g., land use, previous damage experience, etc.).

4. Determine the types of beaver damage problems likely associated with an increase in beaver numbers and those problems least tolerable to landowners.

5. Estimate the probable frequency of beaver complaints associated with increasing beaver populations.

Because highway superintendents contribute substantially to the number of beaver complaints in Region 7, DEC was also interested in the beaver-related attitudes and damage tolerances of these individuals. Therefore, in conjunction with the landowner study, a survey of county and town highway superintendents was developed. The objectives of that effort were identical to objectives 1-3 above, except that they pertained to highway superintendents.

STUDY METHODS

Properties with beaver sites in Region 7 were identified by using DEC beaver habitat maps developed from aerial surveys of potential beaver colony sites (Gotie 1984). Properties were stratified according to the nature of the site located thereon. Listings of landowners in Region 7 who had filed beaver damage complaints were used to develop a separate strata of site-types. Three strata were thus identified for sampling purposes: (1) active sites that had generated complaints (active/complaint sites), (2) active beaver sites that had not generated complaints (active/noncomplaint sites), and (3) sites without beaver activity (inactive sites). All strata were developed based on beaver site data compiled by Region 7 staff for 1983 (however, 1982 listings of beaver damage complainants were included to achieve sufficient sample size). While sampling originally was intended to allow geographic stratification at the WMU level, insufficient numbers of beaver site-types within each WMU dictated a survey design regional in scope.

The names and addresses of landowners (henceforth termed "site-owners") with beaver sites identified on the beaver habitat maps were obtained through the use of DEC Division of Regulatory Affairs wetland landowner listings and through New York county property tax records. A sample of about 200 names was systematically-selected from each of the active/noncomplaint site and inactive site strata with 1 site-owner selected per site. As mentioned previously, to achieve the required sample size of approximately 200 for beaver complainants, all complainants for 1982 and 1983 were included in the study. Considering all 3 strata, the total initial sample size was 679.

A 13-page mail questionnaire (Appendix A) was developed for the site-owner survey. The mailing strategy consisted of an initial mailing and 3 follow-up

reminder letters (Appendix B) spaced at 7-10 day intervals. Survey implementation occurred on 29 January 1985 and the final reminder letter was sent on 21 February 1985.

An abbreviated mail questionnaire was sent to all county and town highway superintendents in Region 7. A total of 149 superintendents were included in that survey. The questionnaire, cover letters and reminder letters are provided in Appendix C.

Due to a greater than expected number of nonrespondents among inactive site-owners, a telephone follow-up questionnaire was developed to determine if major differences existed between inactive site-owner respondents and nonrespondents. A copy of the follow-up questionnaire is located in Appendix D. This questionnaire was administered in a survey of 26 nonrespondents during May 1985.

The responses of site-owners from each sampling strata were weighted to represent site-owners regionally according to the total number of the different beaver site types identified in this study. This weighting procedure was necessary due to the sampling of site-owners at rates disproportionate to their occurence within the region. Therefore, the weighted results allows representation of site-owners' characteristics, attitudes and beaver-related problems and concerns at estimated levels of occurence in Region 7. The weights used (Appendix E) were based on 1983 Region 7 beaver site data compiled by DEC staff. All data were analyzed using the Statistical Package for the Social Sciences (SPSS) computer program.

FINDINGS AND ANALYSIS

The results provided herein are presented in 2 parts: (1) findings obtained from the survey of county and town highway superintendents and (2) results of the site-owner survey. Because they were a supplement to the primary focus of this research, findings from the highway superintendent survey are only summarized within the text; the detailed data are located in Appendix F.

PART 1:

COUNTY AND TOWN HIGHWAY SUPERINTENDENTS

The initial sample size of 149 resulted in 0 nondeliverable and 126 (85% of deliverables) returned questionnaires. All returned questionnaires were codeable. The following results make no distinctions between county and town highway superintendents and responses from both have been used to develop results at the county level.

Recent Beaver Damage

Within the 3-year period of 1982-1984, slightly less than one-half of the highway superintendents in Region 7 experienced job-related problems associated with annual beaver damage; 52% indicated that at no locations in their jurisdiction were roads or other structures damaged by beaver in an "average year" (Table F-1). Region-wide, the number of beaver damage locations reported by superintendents averaged less than 2 and among counties within the region, Oswego and Cayuga superintendents reported the highest average number of damage locations of 2.6 and 1.7, respectively.

Among the types of damage typically encountered, damage to drainage culverts (i.e., obstructed by debris) was experienced most frequently (48%)

(Table F-2). Road surface erosion due to flooding from beaver activities was second in occurrence. A majority (58%) of the superintendents believed that culvert damage was their most important problem overall while 38% believed road surface damage was most important. The impact of beaver activities on road-related problems was further demonstrated by superintendents' reports of the costs for repairing beaver-related damage (Table F-3). In relation to the most important damage mentioned above, our data indicated that each incidence of culvert damage repaired by highway crews required an average of nearly 20 man-days of effort and repair costs, including labor, averaged about $2,200. Using these data, our estimated total cost for beaver damage repairs by superintendents in Region 7 during the period 1982-1984 was about $81,000. Nevertheless, only 1 of the 126 superintendents indicated that part of their annual budget was earmarked for dealing with such damage.

Damage Prevention Efforts and DEC Assistance Desired

Most superintendents with beaver damage reported taking some type of action to prevent damage from recurring, although in many cases that action consisted of requesting DEC assistance. As shown in Table F-4, superintendents were likely to engage in a number of preventative actions with contacting DEC for control information or removal requests appearing among the most common. However, in only 3 of the 9 counties responding did superintendents indicate that a schedule of regular maintenance of problem sites was used to prevent damage. A comparison of the usual preventative actions to the number of damage sites experienced annually by superintendents further indicated that superindendents were less likely to request damage control information or conduct regular maintenance of problem sites if they usually dealt with 5 or

more sites in a given year (Table F-5). Individuals receiving technical damage control information, however, experienced among the lowest levels of damage, perhaps due to the use of such information. Respondents were increasingly likely either to contact DEC for a removal permit or request that DEC remove the beaver themselves as the number of damage sites increased. In other words, as superintendents were faced with increasing numbers of damage sites, they were less likely to attempt control of the problem on their own. Instead, they looked to DEC for assistance.

Assessments of the relationship between years of occupational experience and actions taken to prevent beaver damage provided indications of the differences between superintendents who were "experienced" versus "inexperienced" in dealing with beaver damage (Table F-6). Included among these insights were indications that (1) superintendents having 5 or fewer years of experience were nearly twice as likely not to take preventative actions than were individuals having 6 or more years of experience although most of these less experienced superintendents usually contacted DEC for beaver removal permits; (2) superintendents with only 1 or 2 years of experience were least likely to conduct regular maintenance of problem sites and most likely to remove problem beaver themselves; and (3) superintendents with 1 to 5 years of experience were somewhat more likely to attempt to control damage by modifying the road or other structure than more experienced individuals.

Seventy-two percent of the superintendents who contacted DEC for beaver control information also reported regular maintenance of likely beaver problem areas, thus indicating that the information obtained was incorporated into maintenance practices. Among those same persons who contacted DEC, 60% sometimes requested DEC to remove the beaver while only 40% appeared to use

the information to modify the design of the road or other structure to discourage damage. Few superintendents (17%) who obtained a beaver removal permit actually removed the beaver themselves; more commonly they (i.e., 31%) contacted or hired others to remove the beaver.

Most (58%) of those superintendents who had contacted DEC regarding beaver damage reported satisfaction with the assistance received (Table F-7). The majority (58%) of dissatisfied superintendents cited "no response" as their reason for lack of satisfaction. "Slow DEC response" and "inadequate DEC response" each comprised 16% of the remaining reasons for dissatisfaction. Other findings indicated that superintendents who reportedly contacted DEC for removal permits or to request the removal of beaver were even somewhat more likely than those persons requesting control information to report they were dissatisfied due to no response. These findings may indicate a need for Region 7 staff to clarify communication channels with highway superintendents who are dealing with beaver damage. Previous research by Decker (1976) indicated that few individuals in the general public perceive organizational distinctions relating to responsibilities within DEC. Region 7 highway superintendents may be similar in that they may lack the information necessary to channel their damage-related requests to the appropriate group within DEC. It is possible that many superintendents feel it is sufficient to relay informally their requests through local Environmental Conservation Officers or other DEC field personnel. However, DEC policy mandates that all such requests be acted on within a period of 5 days from receipt at the regional office (J. Proud, DEC, pers. comm., 12 Aug. 1985). It would therefore appear that many requests by superintendents were not reaching the regional office. This may account for

the unexpectedly high percentage of superintendents reporting dissatisfaction due to a lack of response from DEC.

Approximately two-fifths of all superintendents expressed no desire to obtain assistance from DEC regarding control of beaver damage. However, among those superintendents with beaver damage experience, 78% indicated that some type of assistance was preferred (Table F-8). Respondents in this group were nearly equally receptive to obtaining technical information, on-site technical advice, assistance with road or road-structure modifications, or engaging in DEC/highway department cooperative control projects. The least preferable alternative was believed to be in-service training provided to highway crews by DEC staff. This might have been perceived least popular due to a belief by superintendents that in-service training is more appropriate for themselves, not their "crews". In light of our findings that superintendents receiving technical information experienced among the lowest rates of beaver damage, we believe that DEC beaver damage control assistance programs for highway superintendents in Region 7 may be warranted. Special consideration should be provided to those counties experiencing the highest levels of damage-related problems.

Tolerance of Beaver Damage and Beaver Population Levels

Among all superintendents reporting beaver damage, 64% believed damage to roads and other structures was generally tolerable (Table F-9). One-half or more of the superintendents in 4 of the 9 counties within the region perceived the damage as unreasonable. Related analysis indicated that individuals experiencing 4 or more annual beaver damage sites were significantly (X^2 =

5.03, 1 d.f., $P \leq 0.05$) more likely to feel the damage was unreasonable than those with fewer damage problems.

All superintendents were asked to provide their perception of the recent (i.e., 1982-1984) trend in the number of beaver related problems they dealt with in their jurisdictions. Only 5% believed the problems were decreasing while equal percentages perceived the problems to be either increasing (41%) or remaining stable (41%) (Table F-10). Only within Oswego county did a majority of the respondents perceive the problems to be increasing. Additionally, other findings indicated that any person who experienced damage in the time period used as a referent was most likely to believe the number of damage problems was increasing.

In general, superintendents did not appear to be receptive to an increase in the beaver population in Region 7. Only 12% indicated that a population increase would be preferred while about 45% wanted the population to decrease (Table F-11). Respondents with beaver damage experience were significantly (X^2 = 28.89, 4 d.f., $P \leq 0.05$) more likely to want a reduction in beaver numbers than those with no previous beaver damage (Table F-12). Those without damage experience preferred neither an increase nor a decrease; instead, most (60%) preferred the population to remain at current levels. As the number of annual damage problems experienced increased, so did the percentage of superintendents wanting a decrease in beaver numbers. Among persons experiencing damage and who perceived the damage to be unreasonable, 95% desired a decrease in beaver populations. Additional insights into superintendents' tolerances of beaver were sought by exploring other social-psychological and demographic factors.

Superintendents' Experiences with Beaver as Property Owners and Beliefs Pertaining to Beaver

Efforts were made to determine if highway superintendents' attitudes toward beaver were affected by their experiences as private landowners. However, when asked if they currently owned property on which beaver activity occurred, only about 2% answered affirmatively and 93% were certain that beaver were not located on the property. Nevertheless, many superintendents associated potential benefits with beaver-created wetlands. Approximately 3 out of 5 of all respondents indicated they would have 1 or more recreational uses for a beaver-created wetland on their property. Nearly one-half suggested they would use the area for nature observation; hunting and/or trapping were potential uses for one-fourth or fewer of the respondents. As basic indicators of one's value of beaver, these findings imply that superintendents generally recognize potential benefits associated with beaver sites, even though from their vocational perspective, such sites may often be viewed in a negative manner.

From a similar personal perspective, approximately 42% of the superintendents indicated they either enjoyed or had few concerns about the presence of beaver within their town; others worried about their presence (43%) or believed they were a nuisance (15%) (Table F-13). Most superintendents who enjoyed beaver or who believed their presence in the town did not matter also believed the population should be maintained at current levels (Table F-14). On the other hand, those who expressed less tolerance of the presence of beaver felt strongly that the population should be decreased. These findings were consistent with results mentioned previously that indicated that even among respondents lacking damage experience, population increases were not favored.

Previous studies by Connelly et al. (1984), Purdy et al. (1984), Smolka et al. (1984), and Decker and Gavin (1985) have utilized a Wildlife Attitude and Values Scale (WAVS) developed and tested by Project 146 staff to detect distinguishing characteristics among users of wildlife resources. In this study, we used a slightly modified version of that instrument to test attitudinal differences between superintendents indicating they were tolerant of beaver populations in their town versus those who were intolerant. As indicated by the WAVS scores, all respondents were somewhat positive in their attitudinal orientations toward beaver (Table F-15). Nevertheless, statistically significant differences were noted between tolerant superintendents and intolerant superintendents, indicating that intolerant superintendents possessed less positive beliefs about beavers than did tolerant superintendents. No differences were observed between the 2 groups in relation to their scores for beliefs classified as "extractive/economic use beliefs."

Superintendents' beliefs about beaver appeared to reflect their previous experiences with beaver. Intolerant superintendants were likely to value beaver less, desire population decreases, and had experienced more highway maintenance problems associated with beaver damage than superintendents tolerant of beaver populations.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Town and county highway superintendents in Region 7 indicated a general reluctance to have beaver populations increase within their jurisdictions. Most, however, were willing to tolerate current beaver population numbers and associated levels of beaver-related road damage. The results of this study suggest that if the average number of damage locations that each superintendent deals with in an "average year" increases from the current number of somewhat less than 2 to 4 or more, increasing numbers of superintendents are likely to perceive beaver damage as intolerable and would prefer a decrease in the population. The probable result would be an increase in damage complaints filed by superintendents.

The manner in which superintendents' damage complaints and requests for DEC damage control assistance are communicated may be in need of agency clarification. As indicated by respondents, the primary source of dissatisfaction with assistance requests to DEC was that superintendents perceived that no response or action was delivered by the agency. In light of the fact that DEC policy mandates that all such requests be acted on within a period of 5 days from receipt at the regional office, it is questionable whether these requests were received at the regional office at all. We assume that superintendents were, in fact, attempting to place their requests with DEC personnel. We suspect, however, that such requests may often have been communicated informally to DEC field personnel and may not have been received at the regional office. Providing DEC field personnel and highway superintendents with information that clarifies the appropriate procedure for filing damage control requests is likely to increase superintendents' satisfaction with DEC response.

Many highway superintendents in Region 7 relied on DEC provision of damage control information, beaver removal permits, or DEC staff assistance with beaver removal as preventative measures for recurring beaver damage. Fewer individuals attempted regular maintenance of problem sites as a preventative action, especially superintendents with less than 3 years of experience. Encouragingly, nearly three-fourths of those who contacted DEC for technical damage control information appeared to apply that information by implementing a regimen of regular maintenance at likely problem areas. Furthermore, superintendents acquiring such information also reported among the lowest numbers of annual beaver damage locations throughout the region. While this study cannot test the existence of cause and effect in this relationship, these findings may provide an important indication of the potential benefits associated with a DEC program of regional distribution of damage control information.

Among the types of damage control assistance DEC might provide highway superintendents, our findings suggested that no single assistance type was preferred by a majority of respondents. Nevertheless, provision of technical information, on-site advice, assistance with road design modifications, and DEC/highway department cooperative control efforts comprised the assistance types perceived as most preferable by superintendents. Provision of this information/assistance on an ad hoc basis may be most suitable at the current time. In light of the findings of this survey, however, the potential reduction in beaver damage complaints that may result from a program regional in scope should be considered. Existing forums, such as the Annual School for Highway Superintendents conducted by the Cornell University Department of

Agriculture Engineering in conjunction with their Local Roads Program, may be among the most cost-effective outlets for a DEC program of this nature.

Under existing DEC policy, beaver damage complaints filed by highway superintendents have been answered with virtual "curb-service." Sending DEC personnel to the field to verify damage complaints or to assist with control measures may be costly. Encouragingly, the results of this survey suggest that alternative approaches may be effective in reducing both the numbers of damage sites experienced annually by superintendents and, correspondingly, the number of damage complaints they file with DEC.

PART 2:

SITE-OWNERS

Of the initial 679 questionnaires sent to site-owners, 129 (19%) were nondeliverable and 423 (77% of deliverable) were returned. Survey response rates among the 3 sampling strata (classified according to the nature of the beaver site located on the property) were as follows: active/complaint site-owners (85%), active/noncomplaint site-owners (76%), and inactive site-owners (69%).

As mentioned previously, a follow-up telephone survey was conducted with 15 nonrespondent inactive site-owners to determine if major differences existed between inactive site-owner respondents and nonrespondents. Due to the small number of individuals involved in this assessment of nonresponse, the results should be viewed cautiously; we consider them indicative rather than definitive. In summary, our findings indicated that nonrespondent inactive site-owners were generally less involved with beaver, and concomitantly more tolerant than inactive site-owner respondents; nonrespondents were less likely to report having seen evidence of beaver activity or having experienced beaver nuisance or damage problems on their property, and were somewhat more accepting of both having beaver on their property and of current beaver population levels in their town.

Data Analysis Design: Use of a Tolerance Typology

Our original concept for data analysis consisted of site-owner tolerance evaluations based on comparisons of respondents in each of the sampling strata. A review of preliminary survey results, however, indicated that a reclassification of individuals based on their beaver-related experiences and

attitudes would be more suitable for providing insights for wildlife managers. Responses to 3 questions were used to develop this classification. The questions were: (1) "Have you seen any evidence that beaver have been active on the property during the period from 1982 to the present?"; (2) "Generally, how do/would you feel about having beaver on your property?"; and (3) "Would you prefer the Department of Environmental Conservation to increase, decrease, or leave beaver populations at their current levels in the town where your property is located?" The resulting tolerance typology indicated site-owners' tolerance of 1984 beaver population levels in Region 7 based on their previous "experience" with beaver (experience is used here to indicate whether respondents had seen evidence of beaver activity on their property since 1982). The 4 site-owner types developed were (1) experienced, tolerant site-owners, (2) inexperienced, tolerant site-owners, (3) experienced, intolerant site-owners, and (4) inexperienced, intolerant site-owners. Our intended use of this typology is to provide managers with an assessment of existing tolerance attitudes and related site-owner characteristics that may be used in evaluations of the human impact of beaver population management.

The estimated numbers of site-owners represented by this typology, including the relationship of site-owner tolerance types to the nature of the beaver sites owned by respondents, are shown in Table 1. As the data indicate, about two-thirds of all respondents expressed tolerance of current beaver populations regardless of their previous experience with beaver on their property. While the majority of respondents from complaint sites expressed intolerance, nearly 20% of these previous complainants were classified as tolerant site-owners. Among active/noncomplaint site-owners, nearly two-fifths reported intolerance. Yet, none of these individuals had filed a damage

Table 1. Percentages of Site-owners from Each Sampling Strata Included in the Beaver Tolerance Typology.[1]

Tolerance Types	Percent			
	All Site-owners (N=5879)	Active/complaint Site-owners (N=1475)	Active/noncomplaint Site-owners (N=677)	Inactive Site-owners (N=3798)
Experienced-tolerant	32.0	19.7	55.4	28.3
Inexperienced-tolerant	33.9	0.0	7.4	39.7
Experienced-intolerant	20.6	80.3	35.1	16.0
Inexperienced-intolerant	13.5	0.0	2.1	16.0
Totals	100.0	100.0	100.0	100.0

[1]Sample sizes (N) presented in this and other tables in the site-owner analysis represent weighted estimates.

complaint with DEC during the time-period (1982-1984) involved in this study. A surprisingly large proportion (44%) of individuals with sites classified by DEC as inactive were labelled "experienced", thus indicating they had observed evidence of beaver activity on their property during the three-year period. Based on the results of the inactive site-owner nonrespondent follow-up survey, we adjusted that proportion downward to about one-third. This proportion of inactive site-owner respondents who indicated the site was actually active remained larger, however, than the average of 10% generally estimated by the DEC (R. Gotie, DEC, pers. comm., 9 Aug. 1985). This discrepency may be attributable to factors such as respondent misidentification of "evidence" of beaver activity and the three-year time period used as a referent (during which a site may have been both active and inactive). These findings suggest that site-owners' attitudes toward beaver may have been affected simply by their perception of the presence of beaver, regardless of the accuracy of that perception. The following analyses will explore further the factors associated with site-owners' differing tolerance attitudes toward beaver.

Characteristics of Site-owners and Their Properties

Survey respondents were predominately males (84%). The age of responding site-owners averaged 55 years and only about one-in-four was under 45 years of age (Table 2). As reflected by the mean ages of respondents, tolerant site-owners tended to be slightly younger than intolerant site-owners.

By and large, site-owners in Region 7 were permanent residents on rural properties. Only 1% of the site-owners indicated that their property was located in an urban area while 95% reported rural property locations. Sixty-three percent of the site-owners had their permanent residence on the

Table 2. Age Distribution of Site-owners Surveyed.

Years of Age	All Site-owners (N=4397)	Percent			
		Tolerant		Intolerant	
		Experienced (N=1475)	Inexperienced (N=1476)	Experienced (N=909)	Inexperienced (N=588)
Under 35	5.2	9.5	5.3	1.6	0.0
35-45	20.5	21.8	24.3	21.8	6.1
46-55	26.7	31.7	22.8	26.0	25.6
56-65	28.3	18.7	29.6	19.1	62.2
66 and over	19.3	18.3	18.0	31.5	6.1
Totals	100.0	100.0	100.0	100.0	100.0
Mean age	54.7	51.6	53.3	56.9	57.0

property where the beaver site was located, 8% were seasonal residents, 11% resided elsewhere but had a tenant residing on the property, and the remainder (18%) indicated that no one lived on the property. No evidence was found to indicate a difference in tolerance associated with the area in which the property was located or with duration of residence on the property.

The most frequently occurring land-types on site-owners' properties were woodlands, homesites and ponds/wetland areas, each reported by over three-fourths of the respondents (Table 3). One-half or more of the properties contained pastures, croplands, or idle fields. Site-owners' properties averaged about 190 acres and the largest average number of acres for a single land-type reported was 108 acres for site-owners who managed croplands. Specific analyses regarding the relationship between beaver tolerance and land types affected by beaver activities will be presented later in this report. At this point, however, it is worthy to note that for all land types, except croplands, the average acres owned by experienced- intolerant site-owners was smaller than that for experienced-tolerant site- owners.

The most frequently mentioned use of site-owners' properties as well as the single-most important property use reported was use as a homesite (Table 4). As indicated by the analysis according to site-owners' tolerance attitudes, intolerance of beaver activities was more commonly associated with persons who placed commodity values on the products of their land use; site-owners with previous beaver experience were more than twice as likely to be intolerant than tolerant when their most important land use was perceived to be cash crop farming (20% vs. 8%) or timber production (16% vs. 4%). Similarly, among site-owners with no previous experience with beaver on their property, those who perceived their most important property use as cash crop

Table 3. Frequency of Occurrence and Average Size of Land-types of Site-owners' Property.

Land Type	All Site-owners (N=5041)		Tolerant				Intolerant			
			Experienced (N=1272)		Inexperienced (N=1448)		Experienced (N=835)		Inexperienced (N=480)	
	%[1]	y[2]	%	y	%	y	%	y	%	y
Homesite	79	4.7	78	5.2	78	3.9	75	4.7	93	4.1
Woodlands	82	77.9	82	108.3	76	55.5	96	98.1	85	41.9
Pasture	56	46.8	61	67.3	52	36.1	60	44.8	63	42.7
Croplands	53	107.7	49	83.2	55	117.8	72	104.4	51	176.8
Ponds, streams, or marsh	76	25.8	96	30.2	74	12.0	80	22.2	54	26.5
Idle fields	50	33.2	64	43.8	45	24.5	58	34.8	39	18.1
Mean total acres	187.5		231.8		148.3		237.2		186.4	

[1]Percent of site-owners with land type (does not total 100 due to multiple response).

[2]Average acres of land type for properties on which they occur.

Table 4. Uses of Site-owners' Property.

Property Use	All Site-owners (N=4474)		Tolerant				Intolerant			
			Experienced (N=1389)		Inexperienced (N=1519)		Experienced (N=843)		Inexperienced (N=623)	
	P[1]	MI[2]	P	MI	P	MI	P	MI	P	MI
Homesite	69	35	74	39	74	41	52	23	71	30
Farm-cash crops	33	14	39	8	24	9	40	20	30	26
Farm-livestock	33	23	22	14	42	30	36	16	30	32
Farm-orchard	3	1	7	3	2	0	1	0	0	0
Timber products	43	7	56	4	35	5	42	16	34	6
Private recreation	36	13	60	24	23	8	32	13	18	6
Other	8	7	12	8	7	7	10	12	0	0
Total	N/A	100	N/A	100	N/A	100	N/A	100	N/A	100

[1]Percent of respondents indicating a primary use of property (does not total 100 due to multiple response).

[2]Percent of respondents indicating the single-most important use of property.

farming were much more likely to be intolerant (26%) than tolerant (9%) of beaver.

Site-owner Perceptions of Beaver Activity

Approximately 53% of the site-owners responding to the survey indicated they had observed evidence of beaver activity on their property during the period of 1982-1984. As mentioned previously, we categorized these individuals as "experienced" site-owners and have described some of the potential limitations with this definition (e.g., respondent misidentification of beaver activity evidence). Nevertheless, from a management perspective it is important to recognize that a majority perceived beaver activity on their property, with 78% of these site-owners reporting evidence of activity for all three years.

Acres of property flooded by beaver: effects on site-owner tolerance. Site-owners experiencing beaver activity on their properties reported that since 1983 about 10 acres of their property were flooded or covered with water due to beaver in an average year (Table 5). This estimate included both seasonally-flooded land as well as land flooded year-round and was close to the DEC estimate of about 12.5 acres as the average wetland size for active beaver sites in Region 7. Eighteen percent of all experienced site-owners reported that no part of the property was flooded by beaver in an average year. Of that group, slightly over two-fifths were intolerant site-owners. This finding appears to support the above-stated notion that factors other than the actual physical presence of beaver and their related impacts (i.e., flooding) influenced intolerant attitudes toward beaver. Nevertheless, relationships

Table 5. Number of Acres Flooded by Beaver on Site-owners' Property in an Average Year.

Site-owners	Percent by Number of Acres Flooded						
	None (N=395)	0.10-1.0 (N=480)	1.5-2.5 (N=460)	3.0-10.0 (N=551)	11-30 (N=138)	31 or More (N=128)	Mean Acres Flooded
Experienced-Tolerant	57.3	64.1	72.4	63.3	70.2	17.5	5.9
Experienced-Intolerant	42.7	35.9	27.6	36.7	29.8	82.5	11.0
Totals	100.0	100.0	100.0	100.0	100.0	100.0	
All Experienced Site-owners	18.0	21.8	20.9	25.0	8.5	5.8	9.7

were evident between acres flooded (i.e., site size) and site-owner tolerance. The most notable of these was that intolerant site-owners reported nearly twice as many average acres flooded as did tolerant site-owners (11 acres vs. 6 acres, respectively).

Perceived Quantity and Impact of Beaver Damage

Current estimates by wildlife managers in Region 7 indicate that approximately 10%-15% of the active beaver sites are likely to produce beaver damage or nuisance complaints on an annual basis (J. Proud, DEC, pers. comm., 7 June 1984). That estimate, in conjunction with the results of this study, suggests that most landowners on active sites are willing to accept at least some degree of beaver damage. Our findings indicated that 55% of site-owners experienced with beaver (i.e., believing that beaver actually occupied the site) had incurred previous beaver damage or nuisance problems (Table 6); far more than the percentage who actually file complaints. Within the 3-year period 1982-84, the mean number of years in which site-owners had damage was about 2 and, surprisingly, tolerant site-owners experienced no fewer years of damage than intolerant site-owners; in fact, they reported slightly more years of damage (2.3 years vs. 1.9 years, respectively). As indicated, a mere perception of damage did not mean a person was intolerant of beaver. The reasons some site-owners remain tolerant in light of this damage will be discussed below. Relating these reports of damage occurrence to the number of acres flooded in an average year indicated that flooded or active sites of 11 or more acres in size were significantly more likely ($X^2 = 15.71$, 4 d.f., $P \leq 0.05$) to have site owners perceiving beaver damage than for smaller active sites.

Table 6. Years in Which Site-owners Reported Beaver Damage or Nuisance Problems.

Year of Damage	Percent[1]		
	All Experienced Site-owners (N=2369)	Experienced-Tolerant Site-owners (N=1431)	Experienced-Intolerant Site-owners (N=938)
Any Previous[2] Year	55.1	36.9	83.0
1982[3]	66.7	79.9	57.8
1983[3]	68.9	74.1	65.5
1984[3]	72.3	79.2	67.6
Mean Years of Damage	2.1	2.3	1.9

[1]Percent of respondents answering each option affirmatively (multiple response).

[2]Percent of all respondents reporting damage.

[3]Percent of respondents reporting damage in a specific year; reported only by respondents with previous damage.

Presumably, among those factors that influence whether a site-owner with beaver damage requests DEC assistance by filing a beaver damage complaint is his/her perception of the severity of that damage. As shown in Figure 2, our findings indicated that only about one-in-five of the site-owners perceiving damage believed that damage to be severe. Furthermore, Figure 3 shows a strong relationship between a person's general damage severity perception and his/her overall beaver tolerance orientation. As illustrated, site-owners' tolerance of beaver decreased dramatically as their perception of beaver damage increased in severity. In fact, all persons perceiving severe damage were intolerant of beaver. Additional validation of this relationship was provided by comparison of a similar measure whereby respondents with damage indicated whether they believed the amount of damage was "tolerable" or "unreasonable." This comparison indicated that the majority of persons who perceived light (87%) or moderate (77%) levels of damage also believed the damage was tolerable. Conversely, 80% of those perceiving the damage as severe believed it to be unreasonable. Therefore, while tolerant site-owners received damage in as many years as intolerant site-owners, the former individuals generally perceived that damage to be less severe in degree. The following results further substantiate this notion.

Damage types, dollars-of-damage estimates, and site-owners' damage repair efforts. The type of damage resulting from beaver activity that was reported most frequently by Region 7 site-owners was damage to trees (Table 7). Three types alone comprised about four-fifths of all damage reported; these were damage to trees (45%), flooding that resulted in soil erosion (21%), and damage to structures such as fencerows, outbuildings, drainage ditches and

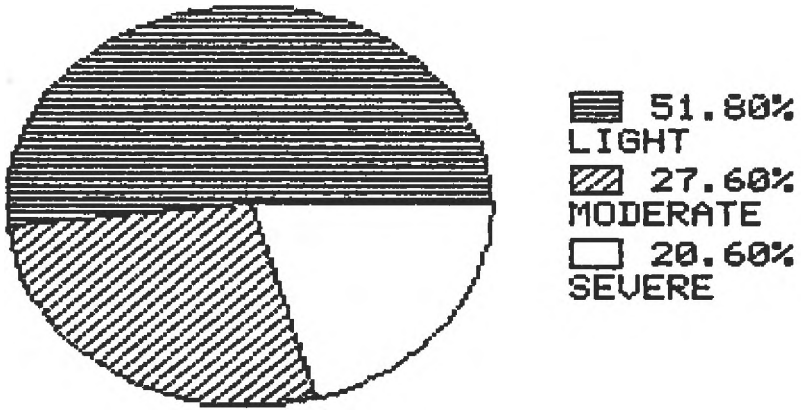


Figure 2. Perceptions of Damage Severity Among Site-owners Reporting Beaver Damage.

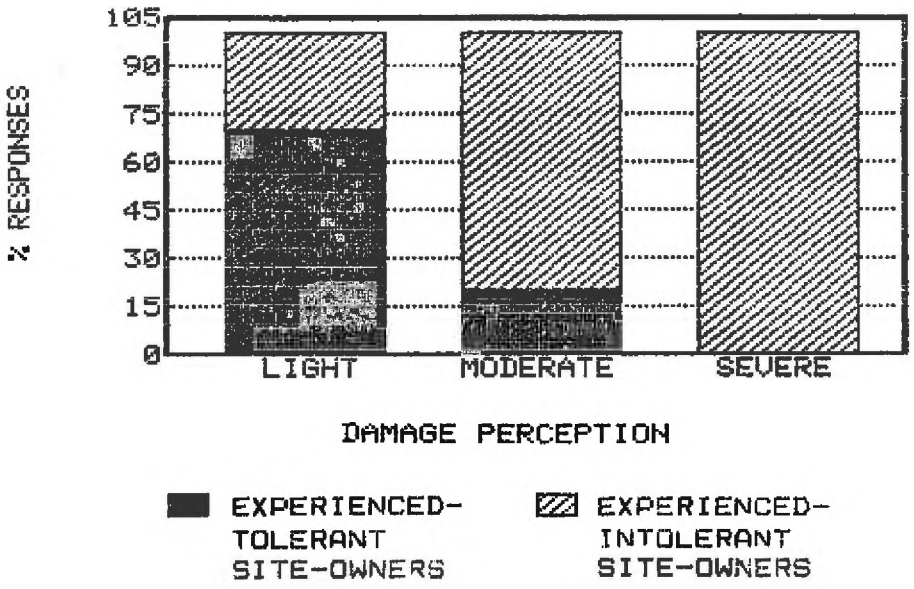


Figure 3. Effect of Perceptions of Beaver Damage Severity on Site-owner Tolerance.

Table 7. Dollars-of-Damage Estimates and Repair/Control Efforts by Type of Damage Reported by Site-owners: 1982-1984.

Site-owners	Damage Types						
	All Types (N=1506) %	Trees (N=684) %	Soil Erosion (N=314) %	Structural (N=253) %	Crops (N=162) %	Culvert Blockage (N=70) %	Other (N=23) %
Experienced-tolerant	36.1	47.4	38.2	17.4	27.8	17.1	0.0
Experienced-intolerant	63.9	52.6	61.8	82.6	72.2	82.9	100.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Aggregate	100.0	45.4	20.8	16.8	10.8	4.6	1.5
Mean Dollars-of-Damage							
Experienced-tolerant	342(215)[1]	297(205)	350(2)	1700 (7)	2000(1)	0(0)	0(0)
Experienced-intolerant	892(568)	1143(158)	167(124)	657(167)	1563(67)	1219(49)	3716(3)
Aggregate	736(783)	666(363)	386(126)	700(174)	1542(68)	1219(49)	3716(3)
Mean Personal Expenses per Repair/Control							
Experienced-tolerant	3(226)	2(192)	2(31)	0(0)	0(0)	117(3)	0(0)
Experienced-intolerant	287(384)	28(114)	131(72)	153(124)	174(16)	1243(54)	2294(4)
Aggregate	181(610)	12(306)	92(103)	153(124)	174(16)	1188(57)	2294(4)
Mean Days per Repair/ Control Effort							
Experienced-tolerant	4(234)	25(184)	23(32)	4(7)	0(0)	9(11)	0(0)
Experienced-intolerant	10(461)	9(164)	18(77)	9(133)	22(62)	8(22)	86(3)
Aggregate	9(695)	4(348)	19(109)	9(140)	22(62)	8(33)	86(3)

[1] ( ) refers to sample size available for calculation of means.

roads (17%). Consistent with their classification in this study, intolerant site-owners comprised the majority of persons reporting each type of damage.

As Table 7 further shows, site-owners' estimates of the dollar value per incident of beaver damage experienced between 1982 and 1984 averaged about $700. Site-owners with crop damage provided the highest estimate at about $1500 per incident. Based on the aforementioned average of 2 years in which damage occurred over the study period, and assuming 1 damage incident per year per site-owner, the annual property damage incurred per site-owner was about $465.

Considering all types of damage, the relationship between mean dollars of estimated damage and site-owners' tolerance attitudes suggested that intolerance of beaver was associated with considerably higher amounts of damage. We further explored this relationship by categorizing estimated dollars-of-damage and identified that category wherein the majority of respondents reporting damage changed from tolerant to intolerant. As shown in Figure 4, this "shift" occured at the $401 to $500 estimate level. Using these data as a simple indicator of tolerance suggested that site owners were willing to incur nearly $400 of damage per incidence and remain tolerant of beaver on their property. Nearly half (46%) of all damaged site-owners were in this estimate category. Combining this estimate with the average of about 2 years in which damage was experienced indicated that Region 7 site-owners were willing to tolerate about $800 of damage per person in return for the presence of beaver on their property from 1982 to 1984, or about $265 per year.

Given this information, we obtained an estimate of the minimum existence value of beaver in Region 7 from 1982 to 1984. Assuming that "inexperienced" site-owners would tolerate similar amounts of damage, we calculated the

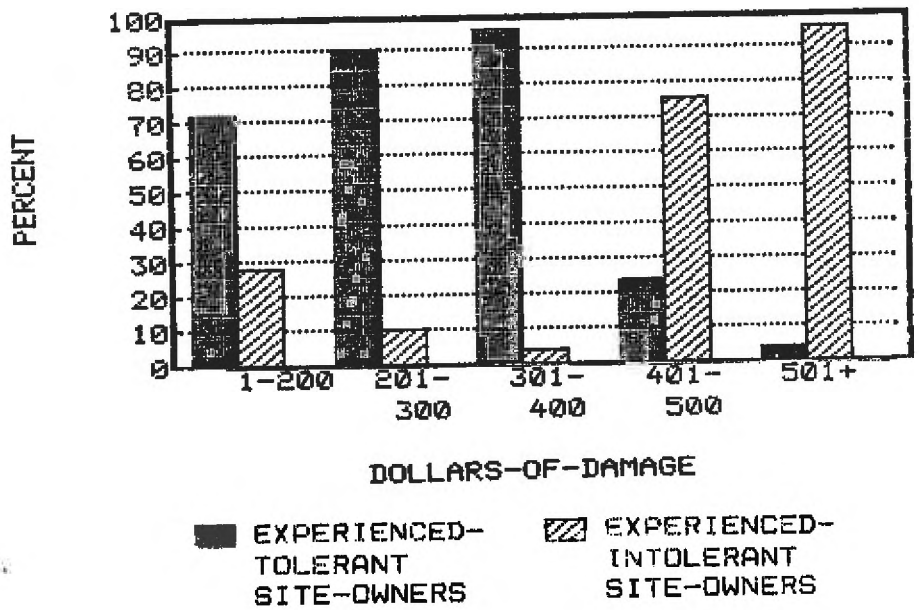


Figure 4. Effect of Dollars-of-Damage Per Damage Incidence on Site-owner Tolerance.

product of the per person indicator of beaver value ($800) and the minimum number of site owners reported earlier (N=5879). The result indicated that the existence of beaver in Region 7 between 1982 and 1984 had a minimum net worth of about $4,700,000 to the population of site-owners, or about $1,567,000 per year.

From a damage control standpoint, additional indicators were analyzed for the purpose of assisting evaluations of the amount of resources warranted by DEC damage control efforts. These were site-owners' out-of-pocket expenses and days allocated for beaver damage repair or control efforts. As shown in Table 7, site owners' mean expenses for repair/control per incidence of beaver damage was nearly $200; approximately one-fourth the amount of the estimated dollars-of-damage. Again, using the average of 2 years in which site-owners incurred damage over the 3-year study period, and assuming 1 damage incident per year per site-owner, the annual damage repair/control effort per site-owner cost about $120. The number of days allocated (counting any part of a day as a whole day) to repair/control efforts averaged 9. Consistent with earlier findings, tolerant site-owners spent fewer personal dollars and days for repair/control. The largest expense per type of damage was reported for types that occurred infrequently among site-owners; culvert blockage and "other" (e.g., septic tank replacement). For culvert damage, site-owners generally spent about as much to repair or control future damage as the estimated amount of damage itself.

To estimate the fiscal requirements of an agency program designed to offset potential complainant site-owners' expenses for repair or control, we analyzed the effect of out-of-pocket repair/control expenses on tolerance

attitudes by assessing the possibility of tolerance "shift" as described previously. Figure 5 illustrates that in effect, no shift or tolerance "cross-over" occurred. That is to say, site-owners with any out-of-pocket expenses for repair/control of damage were generally intolerant of beaver. Our data, therefore, indicate that damage control programs designed to offset the expenses of beaver damage complainants would need to be based on the average value of about $300 per incidence of damage reported by intolerant site-owners (i.e., those site-owners most likely to complain). Assuming the percentage of active sites (N=950 [based on 1983 beaver survey data]) from which beaver complaints emanate remains at 10%-15% annually (we will arbitrarily use 10% in this example) such a program would require at least $28,000 per year to maintain. While this exercise has not been intended to assess the feasibility of such a program, it has helped illustrate the impact of beaver damage on site-owners and we hope the above estimates will prove useful to Region 7 managers who want to compare the relative merits of alternative damage control approaches.

Actions Taken by Site-owners to Control Beaver Damage and Satisfaction with DEC

Overall, only about 60% of those persons reporting damage took action to control the beaver damage (Table 8). The majority of these respondents were intolerant site-owners. Among those individuals who attempted to control damage, allowing others to trap beaver at the site was the most frequent response. Most site-owners who contacted DEC requested both control information and a beaver removal permit. Those with removal permits, however, relied largely on the assistance of others in their control efforts; 76% requested removal assistance from DEC, 66% allowed others to do the trapping,

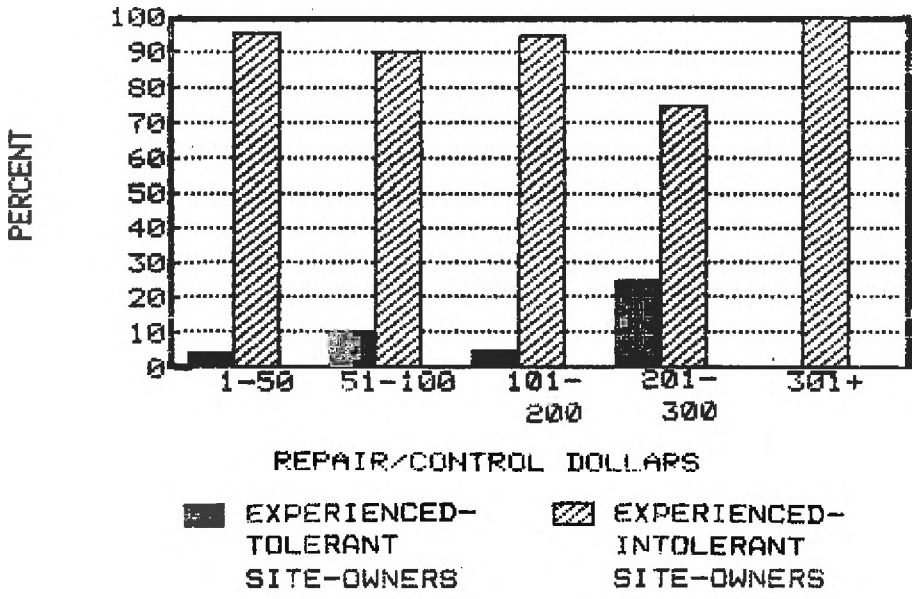


Figure 5. Effect of Repair/Control Expenses Per Damage Incidence on Site-owner Tolerance.

Table 8. Actions Taken by Site-owners to Control Beaver Damage.

Action Taken	Percent[1]		
	All Site-owners (N=1227)	Experienced-Tolerant Site-owners (N=527)	Experienced-Intolerant Site-owners (N=700)
None	42.8	75.1	18.5
Contacted DEC for control information	19.4	8.7	27.4
Contacted DEC for removal permit	14.3	1.9	23.6
Requested DEC to remove beaver	21.8	8.7	31.6
Personally trapped beaver	3.1	0.2	5.3
Others trapped beaver	35.4	27.5	41.4
Removed beaver-not by trapping	9.1	1.7	14.6
Attempted control without removing beaver	18.3	13.2	22.1
Other	0.6	0.0	1.0

[1]Percents refer to respondents answering each option affirmatively (multiple response).

and only 10% removed the beaver themselves. Nearly 15% of those site-owners requesting a removal permit reported removing beaver but by using methods (unspecified) other than trapping.

Site-owners' satisfaction with DEC response to their beaver damage inquiries was mixed; only about one-half of those persons contacting DEC were satisfied with the response, regardless of the nature of the request. The percentages of satisfied site-owners by request type were (1) control information request (49%), (2) removal permit request (45%), and (3) removal by DEC staff request (51%). Two classes of responses comprised all reasons given for dissatisfaction -- No DEC response or action (74%) and insufficient response (26%). Recalling the aforementioned findings of a similar nature in the highway superintendent section of this report, we suspect that similar causes may be attributed to dissatisfied respondents' perceptions of inaction on part of DEC. That is, many site-owners' requests for agency assistance may have been communicated informally to DEC field personnel who, in turn, may not have relayed that request to the regional office. As before, our assumption should not be interpreted as the sole cause for this problem, other unidentified factors may influence the situation. This finding should, however, be used as an indication that channels of communication for delivering beaver control requests to the regional office may be in need of review and clarification.

Estimation of Damage in WMU 10 Associated with an Increase in Beaver Populations

As mentioned at the outset of this report, the beaver population of WMU 10 in Region 7 is currently maintained at a level to achieve about 10% site-occupancy, well below the 30% level achieved in other WMU's that is considered

near carrying capacity. Increasing beaver population levels in WMU 10 has been questioned by DEC due to a perceived potential for significant management problems related to increased numbers of damage complaints. While the results of this study cannot provide exact projections of the nature and magnitude of damage that would result from increasing beaver in WMU 10, several insights have been provided in this report that may assist managers in making more sensitive assessments of the impacts of increasing beaver numbers in the WMU.

Given our findings to this point, broad estimates can be developed for the expected impact of beaver damage on WMU 10 site-owners. Our estimates pertain to an increase in the beaver population to a level achieving 30% site occupancy (i.e., carrying capacity).

Site estimates from 1983 beaver survey data compiled by Region 7 staff show a total of 2245 beaver sites in WMU 10. Of this total, only 203 (9%) were active and the remainder were inactive. If the percent of active sites were increased to 30% (n=673), the results of this study suggest that at least 1 site-owner on 55% (n=370) of those sites would, at some point during the year, believe they had incurred beaver damage. For the sake of simplicity, we will assume only 1 owner per site and that owners of inactive beaver sites would not perceive that beaver were present at the site and, therefore, only owners of active sites would be reporting damage. Given this minimum estimate of damaged site-owners, a proportion of complaint sites can be calculated. For example, if 15% of the sites produced complaints, about 55 complaints may be expected.

Previous findings of the relationship between dollars of estimated damage and beaver tolerance attitudes suggested that approximately 45% of the damaged site-owners (n=166) would incur $\leq$\$400 of damage and remain tolerant of beaver.

Obviously, however, only a fraction of the 200 or so remaining site-owners with expected damage of >$400 and with intolerant attitudes would likely file damage complaints.

Site-owners' estimates of the average annual dollars-of-damage (approx. $465) resulting from beaver activity suggest that at 30% site occupancy, the damage incurred by site-owners in WMU 10 would total about $170,000 annually. This represents an increase of nearly $120,000 in damage over the level estimated at the current 9% site occupancy. Also on an annual basis, the personal expenses (approx. $120 per year) that site-owners would incur in repairing or controlling damage associated with a 30% occupancy rate was estimated at about $44,000, or an increase of $31,000 over current amounts.

Site-owners' Beaver Damage Control Concerns

Property affected. The types of property that site-owners believed most likely to be affected in the event of future beaver damage were diverse. As shown in Table 9, a slight majority (52%) of site-owners recognized, as expected, that ponds or other wetland areas were most likely to be affected, while woodlands (often in close proximity to wetland sites) were perceived as second most likely (47%) to receive damage. Those site-owners perceiving that woodlands or crops would be affected (property types with typically large dolars-of-damage estimates) were typically intolerant of beaver. Furthermore, inexperienced intolerant site-owners shared a somewhat greater concern for crop damage than did intolerant site-owners with previous beaver experience.

When asked to indicate the single property type where controlling any damage would be most important, nearly 40% of tolerant site-owners replied "none" (Table 10). This indication of a lack of concern for control was

Table 9. Site-owners' Perception of Property Types Likely to be Affected by Beaver Damage.

Property Type	Percent[1]				
	All Site-owners (N=4567)	Tolerant		Intolerant	
		Experienced (N=1439)	Inexperienced (N=1555)	Experienced (N=950)	Inexperienced (N=623)
Don't know	4	3	9	0	0
Homesite	14	10	9	17	34
Woodlands	47	44	35	67	53
Pasture	24	15	22	38	30
Croplands	19	14	12	27	37
Ponds/wetlands	52	53	55	58	36
Idle fields	23	27	17	22	30
Access roads	15	14	7	26	23
Recreation site	8	9	2	14	11

[1]Percents refer to respondents answering each option affirmatively (multiple response).

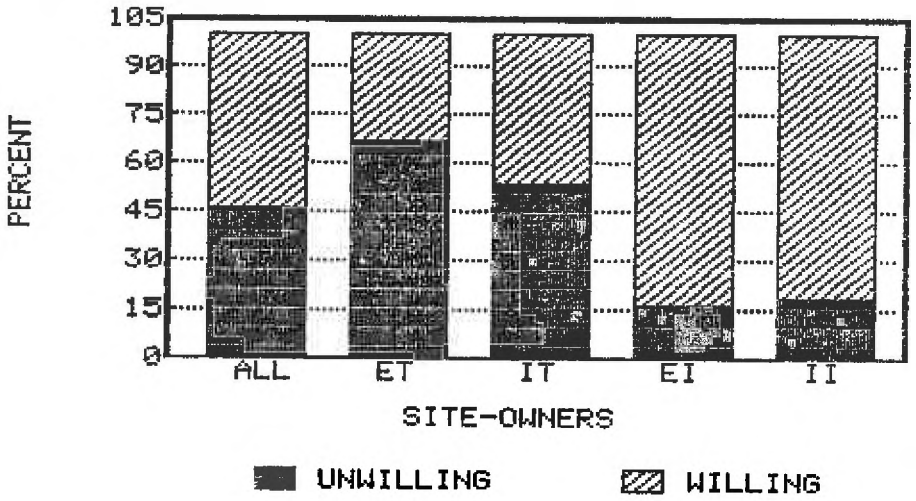
Table 10. Site-owners' Perceptions of Property Types Where Beaver Damage Control Is Most Important.

Property Type	Percent[1]				
	All Site-owners (N=4567)	Tolerant		Intolerant	
		Experienced (N=1439)	Inexperienced (N=1555)	Experienced (N=950)	Inexperienced (N=623)
None	28	39	39	10	6
Homesite	8	4	7	12	13
Woodlands	18	18	17	20	20
Pasture	5	4	7	5	0
Croplands	16	10	9	19	42
Ponds/wetlands	11	11	14	8	6
Idle fields	2	3	0	5	0
Access roads	8	10	5	11	7
Recreation site	4	1	2	10	6
Totals	100	100	100	100	100

[1]Percents may not total 100 due to rounding.

undoubtedly a reflection of their history of infrequent encounters with beaver damage and, among those who have experienced damage, their perceptions of generally non-severe damage. Nevertheless, among those 60% with damage concerns, woodlands, ponds/wetlands and croplands were areas of the greatest control interest. As for the 2 types of site-owners classified as intolerant of beaver, 90% or more provided responses indicating they did indeed have a single property type for which they were most concerned about controlling beaver damage. These responses once again indicated woodlands and croplands were the property types of most concern and that intolerant site-owners lacking previous experience with beaver were twice as concerned about potential crop damage as were intolerant site-owners with beaver experience.

Willingness to implement beaver control actions. Given these concerns about controlling damage, site-owners were asked whether they were willing, if provided technical information, to "make their property less attractive" for beaver (i.e., beaver habitat modification) in order to prevent future damage problems. Slightly over one-half (54%) of all site owners responded affirmatively to this question (Figure 6). Among site-owners tolerant of beaver, however, only 33% of the experienced respondents and 45% of the inexperienced respondents appeared receptive to the notion of habitat modification. On the other hand, intolerant site-owners would appear to welcome technical information that would aid in the prevention of future beaver damage problems; no fewer than 80% of both experienced and inexperienced intolerant site-owners were willing to conduct habitat modifications. Reasons given by site-owners who were unwilling to discourage beaver indicated their



ET = EXPERIENCED TOLERANT SITE-OWNER
IT = INEXPERIENCED TOLERANT SITE-OWNER
EI = EXPERIENCED INTOLERANT SITE-OWNER
II = INEXPERIENCED INTOLERANT SITE-OWNER

Figure 6. Willingness of Site-owners to Discourage Beaver by Habitat Modification.

opposition was related more to their positive attitudes toward beaver and their perceived benefits of wetlands rather than a negative attitude toward the control approach. That is, a combined 43% suggested they were not willing to discourage beaver either because they enjoyed beaver on their property or they enjoyed the wildlife habitat provided by the wetland. Another 42% believed that damage occurred too infrequently to warrant such actions and only 7% believed that habitat modification would be prohibitively expensive. These findings provide encouraging indicators of the receptiveness of site-owners to a low-cost agency program of providing technical information for purposes of beaver damage mitigation. Other factors analyzed in this report (e.g., personal damage control expenses and days of damage control effort) indicate that most site-owners with interest in damage control are likely to be adequately motivated to engage in such projects. Furthermore, any regional program designed to distribute damage control information should include consideration of the property types where damage control is of greatest concern to site-owners, the constraints imposed by site-owners' personal expenses for undertaking control efforts, and the sources of information most suitable for reaching the audience of interest. Information designed to aid decisionmaking with regard to the latter consideration is provided below.

Damage control information source preferences. Among the numerous potential outlets of information available to assist site-owners' beaver control efforts, some were perceived as more preferable than others. As shown in Table 11, 2 sources each were selected by over 50% of all respondents; county Cooperative Extension agents and DEC's magazine "The Conservationist." The 3 least-preferred sources among all site-owners were radio (14%), farm

Table 11. Sources of Information Most Preferred by Site-owners for Obtaining Beaver Damage Control Information.

Information Source	Percent[1]				
	All Site-owners (N=4133)	Tolerant		Intolerant	
		Experienced (N=1346)	Inexperienced (N=1376)	Experienced (N=860)	Inexperienced (N=552)
Cooperative extension agent	61.3	57.5	61.5	67.3	61.0
DEC "Conservationist"	52.7	57.7	54.2	50.3	40.3
DEC pamphlet	39.4	53.7	40.1	40.4	1.3
Farm organization (e.g., Grange, Farm Bureau)	20.8	18.3	24.0	16.5	26.0
Federal conservation organization (e.g., ASCS, SCS)	44.4	37.5	46.4	54.5	40.3
Newspapers	23.0	12.8	21.9	22.0	51.9
Radio	14.2	10.0	18.7	5.8	26.0

[1]Percents refer respondents answering each option affirmatively (multiple response).

organizations (21%), and newspapers (23%). While those sources presented above may be suitable for reaching a majority of site-owners, the data indicate that a multi-source approach may be optimal.

Site-owners' Attitudes and Beliefs About Beaver

A Wildlife Attitudes and Values Scale (WAVS) similar to that used in the survey of highway superintendents was employed to determine possible differences among site-owners in relation to their beliefs about beaver. Development, testing, and previous applications of the WAVS suggests the measure provides both a valid and reliable indication of peoples' values relative to wildlife. For our purposes, scale statements were modified to reflect beliefs about beaver. These beliefs can be categorized into 3 groups: (1) noneconomic/nonextractive-use beliefs, (2) economic/extractive-use beliefs, and (3) problem tolerance beliefs. As the results in Figure 7 illustrate, our classification of respondents as tolerant or intolerant site-owners was consistent with their basic beliefs about beaver.

The distribution of responses to noneconomic/nonextractive-use beliefs indicated that tolerant site-owners typically had more positive values of an "appreciative" nature about beaver than did intolerant site-owners. In particular, tolerant site-owners were much more appreciative or supportive of the roles that beaver assume as indicators of environmental quality, as creators of wetland environments, and of their overall ecological role.

Problem-tolerance belief responses demonstrated similar respondent traits. Tolerant site-owners were more likely to support the notion of personally tolerating beaver damage, nuisance problems, or the risks of disease associated with beaver than were site-owners classified as intolerant.

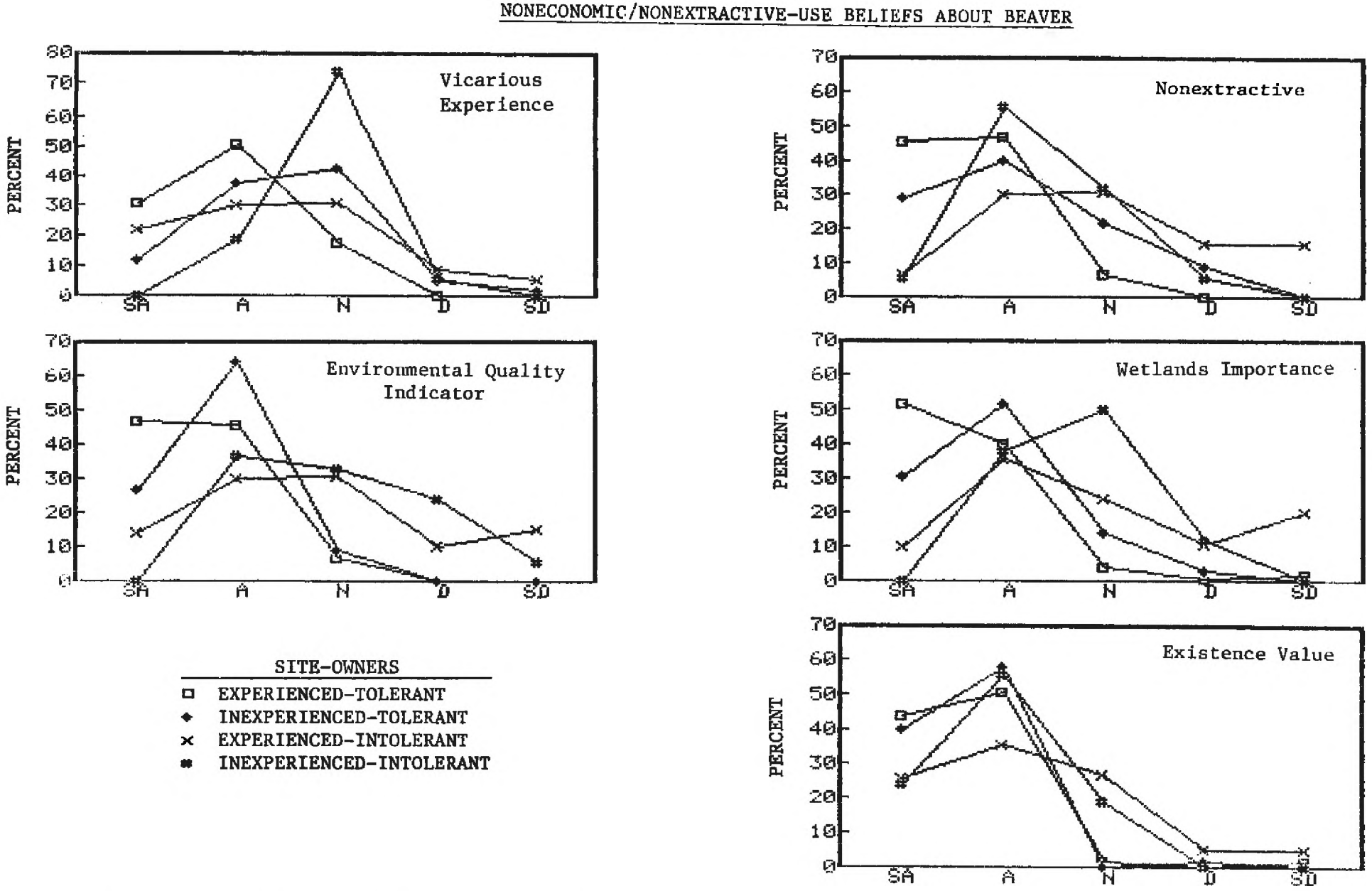


Figure 7. Distribution of Responses to Wildlife Attitudes and Values Scale Items (SA=Strongly Agree, A=Agree, N=Neither Agree nor Disagree, D=Disagree, and SD=Strongly Disagree).

NONECONOMIC/NONEXTRACTIVE-USE BELIEFS ABOUT BEAVER (CONTINUED...)

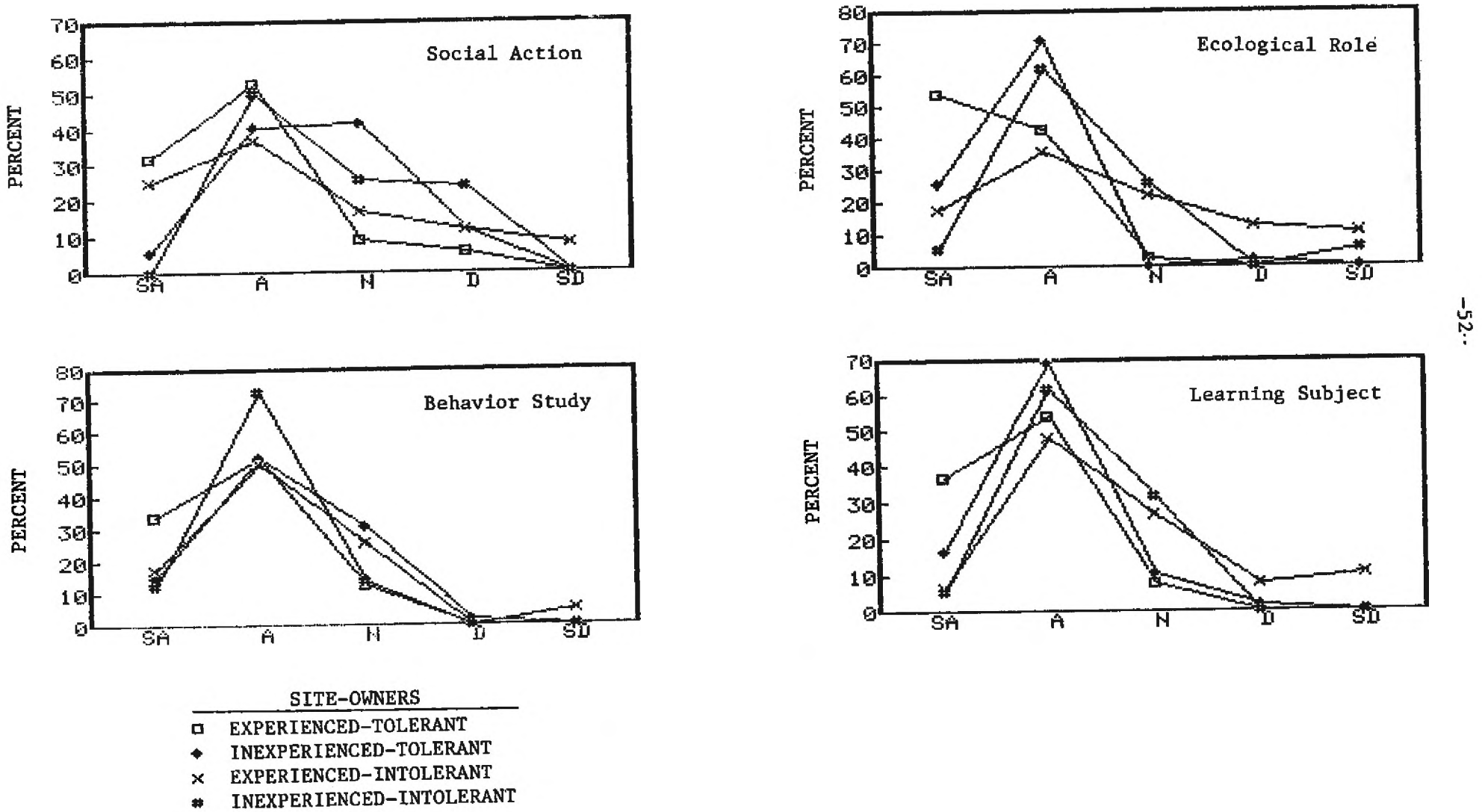
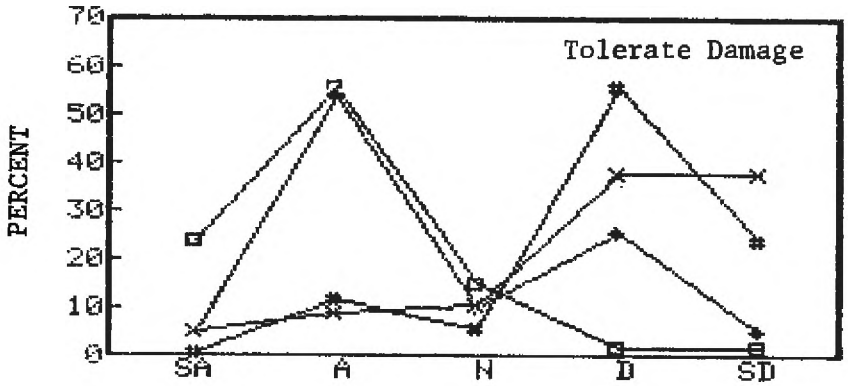
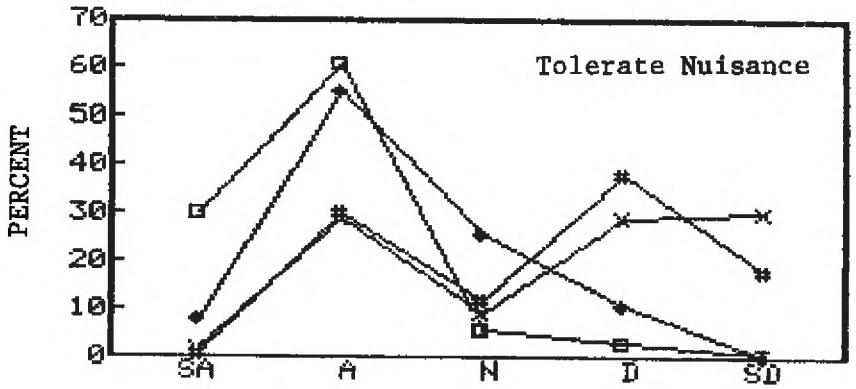
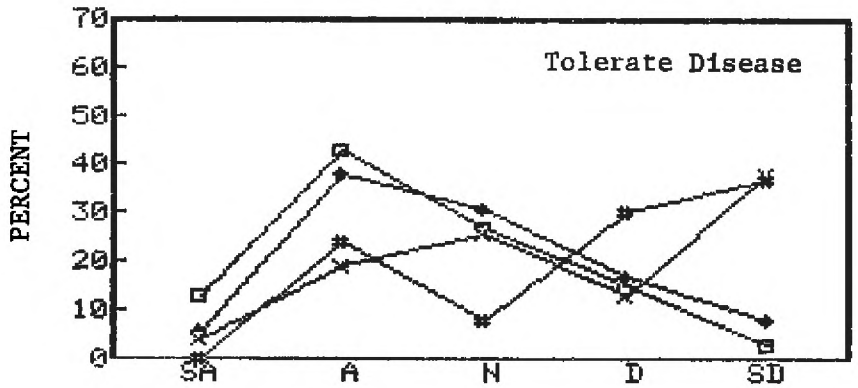


Figure 7. (Continued).

PROBLEM-TOLERANCE BELIEFS ABOUT BEAVER







SITE-OWNERS

- □ EXPERIENCED-TOLERANT
- ◆ INEXPERIENCED-TOLERANT
- × EXPERIENCED-INTOLERANT
- ✱ INEXPERIENCED-INTOLERANT

Figure 7. (Continued).

ECONOMIC/EXTRACTIVE-USE BELIEFS ABOUT BEAVER

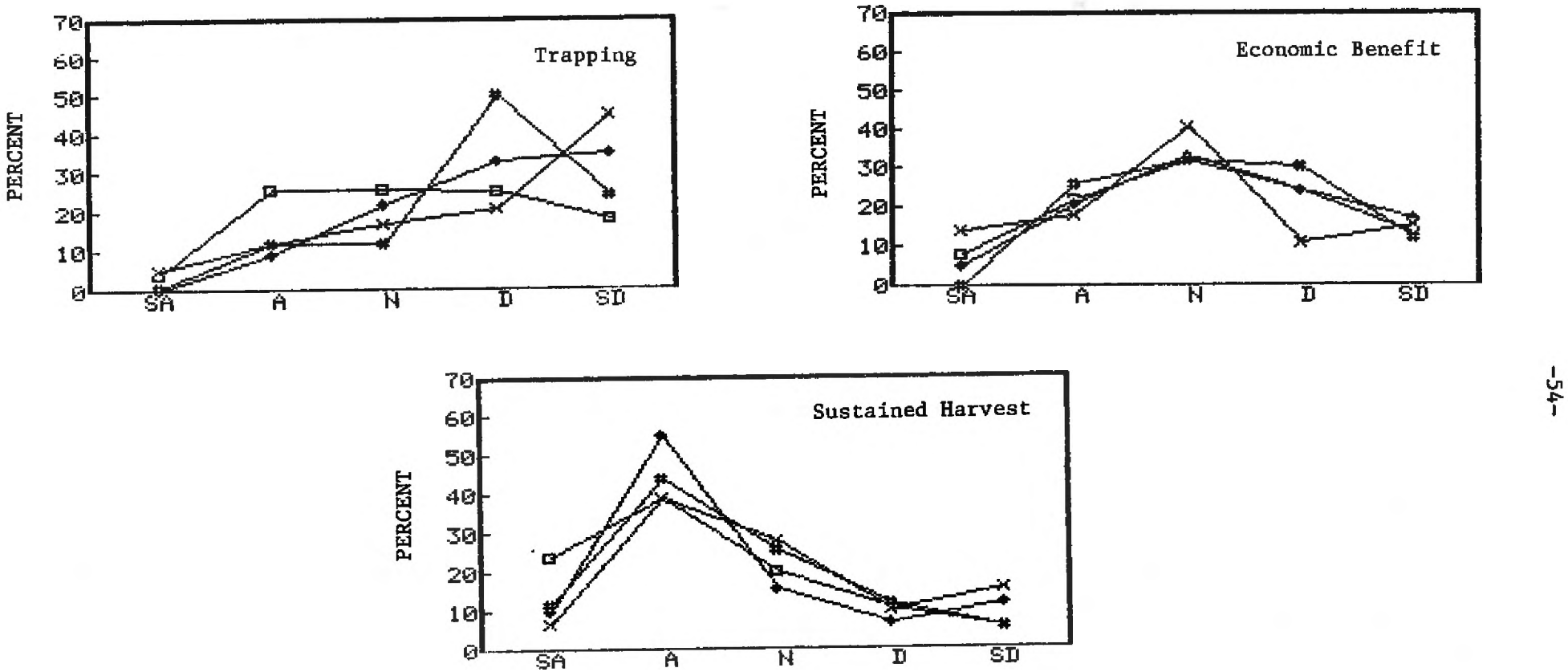


Figure 7. (Continued).

The response distributions of tolerant and intolerant respondents to the belief regarding tolerance of beaver damage showed the acute opposition of opinions reflected elsewhere in this study; the proportions of tolerant respondents agreeing with the belief were nearly diametrically opposed to that of intolerant individuals who disagreed.

The scores regarding extractive/economic uses of beaver reflected a general disagreement with such uses. While all respondents typically agreed that "beaver should be managed for human use without harming the future of the beaver population", most disagreed that they would enjoy trapping themselves. This attitude appeared to be reflected in damaged site-owners' reliance on others to remove problem beaver from sites, as reported earlier. Respondents' lack of support for beaver trapping was also evident in responses that were split between approving, disapproving, and "neutral" regarding the belief that beaver trapping benefited local economies.

Attitudes related to wetland uses. Another indicator of site-owners' values of beaver was reflected in their potential recreational uses of wetlands created by beaver on their property. From this recreational-use perspective, however, about 43% of all site-owners appeared to place little value on the site as indicated by their response stating they had no such use for a wetland (Table 12). Nearly two-thirds of all intolerant site-owners replied similarly to this option. The majority of all site-owners, however, especially those classified as tolerant, recognized many of the recreational benefits associated with the presence of beaver sites. While the opportunity for nature or wildlife observation was perceived by the single largest percentage (42%) of

Table 12. Site-owners' Recreational Uses of Wetlands Created by Beaver on Their Property.

Site Uses	Percent[1]				
	All Site-owners (N=4464)	Tolerant		Intolerant	
		Experienced (N=1432)	Inexperienced (N=1555)	Experienced (N=854)	Inexperienced (N=623)
None	42.8	12.8	49.8	63.9	65.5
Nature/wildlife observation	41.9	67.8	42.9	18.7	11.5
Fishing	30.3	51.8	21.7	19.7	17.2
Trapping	19.4	33.9	14.3	18.6	0.0
Hunting	27.2	50.4	19.4	18.4	23.0

[1]Percents refer to respondents answering each option affirmatively (multiple response).

respondents as the type of use they were most likely to have, over one-fourth also suggested they valued sites for hunting and fishing uses.

Preferences for beaver population levels and perceptions of beaver abundance. As indicated in the discussion of the development of the tolerance typology used in this analysis, site-owners' attitudes about beaver populations were incorporated into the typology. A summary of the attitudes for the major groups of tolerant and intolerant site-owners follows:

> Tolerant site-owners -- This group of site-owners, both experienced and inexperienced with beaver, comprised about two-thirds of all respondents. While 71% of this group indicated that the presence of beaver on their own property was either enjoyable or did not matter to them personally, the remainder were worried about the possibility of damage. Nevertheless, all tolerant site-owners had the additional characteristic of believing that beaver populations should either be maintained at current levels (71%) or increased in size (29%).
>
> Intolerant site-owners -- Individuals characterized by intolerant attitudes, regardless of their previous experience with beaver, comprised about one-third of all site-owners. While some (6%) did not strictly oppose the presence of beaver on their own property, most (70%) respondents classified as intolerant believed, nevertheless, that the beaver populations should be decreased in size. None preferred a population increase.

Overall, site-owners preferred beaver populations to remain at 1984 levels; nearly 60% wanted the population to remain at that level of abundance while site-owners preferring increases or decreases were represented equally at about 20% each.

DEC beaver survey data indicate that the recent abundance of beaver in Region 7 has generally been among the highest levels experienced in many years. Few site-owners, however, have perceived this increase; overall, only 30% reported a noticeable increase in beaver since about 1980 in the town in which their property was located (Table 13). About two-thirds of intolerant site-owners experienced with beaver believed the population had increased

Table 13. Site-owners' Perceptions of the Change in Abundance of Beaver Since 1980 in the Town in Which Their Property is Located.

Beaver Abundance Change	Percent				
	All Site-owners (N=4552)	Tolerant		Intolerant	
		Experienced (N=1460)	Inexperienced (N=1519)	Experienced (N=949)	Inexperienced (N=623)
More	30.0	34.7	8.0	65.7	18.4
Same	11.9	16.5	9.9	12.1	5.7
Fewer	11.8	15.0	12.3	5.6	12.6
Unknown	46.3	33.8	69.8	16.6	63.3
Totals	100.0	100.0	100.0	100.0	100.0

while most inexperienced site-owners lacked a perception of change in beaver abundance.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

The results of this survey of owners of beaver sites in DEC Region 7 has provided wildlife managers with important insights into public tolerances of beaver. As with other wildlife resources, such as deer, the concept of "management by least complaints" has played an important role in the establishment of beaver management policies. The information supplied by this study, however, allows managers to begin developing beaver management plans that are less "reactive" in nature by incorporating into the planning process human tolerance concerns associated with changes in the distribution and abundance of beaver.

To date, most owners of beaver sites in Region 7 appear to be tolerant of the levels of beaver associated with the population increases that have been achieved in the Region; only one-fifth of the site-owners responding to this survey indicated that a population decrease was preferable. It is important for managers to note, however, that further population increases were not believed to be desirable among most of the other site-owners. Instead, current levels of beaver were preferred.

While evaluations of site-owners' tolerance of beaver within specific WMUs in Region 7 were beyond the scope of this study, we believe that some differences may exist in relation to the different population densities of beaver within WMUs. Until these differences are better understood, however, managers should proceed cautiously with any plans to increase beaver in WMUs currently below carrying capacity. Nevertheless, indicators are available to help guide these planning efforts. For instance, we have demonstrated how DEC beaver survey data can be combined with findings from this study to assess more accurately than previously possible, the numbers of site-owners that may

incur damage and the number of complainants expected from a specific percentage increase in site occupancy by beaver. Managers' assessments of the resources required to handle the increase in complaints will continue to be a limiting factor to the potential for beaver population increases.

The results of this study have further provided estimates of the costs of beaver damage incurred by site-owners, from both a property impact and damage repair/control perspective. Ethical questions arise from these findings: What responsibility does an agency have for the costs of property damage and personal damage repair/control expenses incurred by site-owners as a result of beaver management policies? To what extent should agencies mitigate those costs? While these questions must ultimately be resolved by decisionmakers, this study has provided findings that should prove useful to such considerations. Specifically, our results indicated that site-owners incurring damage were likely to tolerate $\leq$\$250 of beaver damage each year in return for the presence of beaver and beaver-created wetlands on their property. Nearly one-half of the respondents to this survey were within that limit of economic tolerance. We may assume, therefore, that levels of tolerable damage would be exceeded for about one-half of those persons expected to incur beaver damage as a result of population increases within a WMU. In addition, most of these individuals will have personal, out-of-pocket expenses for damage repair/control efforts averaging about \$300 per damage incidence. Past experience indicates that only a portion of damaged individuals are likely to file damage complaints with DEC. Nevertheless, as a group, intolerant site-owners may be viewed as "high probability complainers" and are most in need of and receptive to DEC-supported damage control programs. Their previous experiences with beaver damage and past control efforts indicate they are

strongly motivated to implement damage control measures in areas of most concern (these include woodlands, croplands, and existing ponds or wetland areas). Providing effective damage control information to intolerant site-owners should have the added benefit of reducing their perceived costs of damage and concomitantly, the levels of intolerance (and complaint potential) among these individuals.

Additional research is needed to assess more precisely the impact of beaver control/damage mitigation measures on beaver tolerance attitudes, including perceptions of beaver damage costs. These assessments, such as pre- and post-damage control evaluations of tolerance, may be conducted on selected sites in Region 7 and should employ available and practical damage control approaches ranging from simple technical information to flood control devices. Efforts such as these would allow managers to select control methods for use in damage control programs that are most cost-effective from both an environmental and human tolerance perspective.

The extent of damage control assistance provided by DEC to site-owners must also be considered. Until more precise information about control approach cost-effectiveness is available, site-owners' estimates of the nature and costs of beaver damage may serve as important guidelines to control approach assessments. For each type of damage identified in this study for which control measures may be considered, it is clearly important that the costs associated with control do not exceed the costs of the beaver damage itself.

The results of this study showed that most owners of beaver sites in Region 7 had positive beliefs about the values of beaver and beaver-created wetlands. We found this to be true even for site-owners classified as intolerant of beaver (although the intensities of their beliefs were generally

weak). Among DEC's wetlands programs alternatives that could incorporate, and perhaps build upon these values are those of DEC-landowner cooperative efforts. Such a program may involve agency promotion of the positive aspects of being an "owner" of wetlands, reducing the disencentives of maintaining beaver and wetlands by providing appropriate damage control information or assistance, and enabling site-owners to identify themselves as program cooperators by posting "Wetlands Cooperator" signs on their property. The benefits of such an innovative approach to the maintenance of wetland environments and public tolerance of beaver may be substantial.

Management of beaver populations will continue to require an integration of biological and sociological considerations. Maintaining the delicate balance between desired population levels and human tolerance will be one of the wildlife manager's most challenging tasks. Developing an understanding of property owners' tolerance of beaver and beaver damage, however, will better prepare managers to make the decisions necessary to provide responsive and successful management programs.

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LIST OF APPENDICES

APPENDIX A

Site-owner Questionnaire

CENTRAL NEW YORK BEAVER MANAGEMENT SURVEY

CENTRAL NEW YORK
BEAVER MANAGEMENT SURVEY

Conducted by the
Department of Natural Resources
in the State College of
Agriculture and Life Sciences
Cornell University

This survey is being conducted to determine the concerns, interests, and opinions of landowners in Central New York regarding beaver management. The New York State Department of Environmental Conservation has asked us to obtain this information for purposes of updating beaver management programs in your area. The following brief questions give you an opportunity to express your opinions.

We would like the addressee to complete this questionnaire as soon as possible, seal it, and simply drop it in the mail; return postage is provided. Your answers will remain confidential. Your assistance with this survey is critical to beaver management programs that consider your needs and those of other residents in your area.

THANK YOU FOR YOUR COOPERATION.

YOUR PROPERTY AND BEAVER

Recent aerial photographs have been studied to determine the locations of wetland sites that are (1) currently occupied by beaver or (2) have the potential to become occupied if beaver move into the area. These sites are typically stream drainages, ponds, or other wetlands. Property records indicate that you own, in whole or part, such a site. The following questions refer to either CURRENTLY OCCUPIED or POTENTIAL beaver sites that have been located on property you own.

1. Do you think you know which property of yours has a site that beaver are <u>currently</u> occupying or have previously occupied and might <u>potentially</u> return to in the future?

   ☐ YES

   ☐ NO
   ☐ UNCERTAIN

   If you cannot identify definitely that property with a current or potential site, please think about the property you own that you would most suspect to be suitable for beaver and answer the following questions with that property in mind.

2. How would you describe the area where that property is located?

   ☐ URBAN

   ☐ SUBURBAN

   ☐ RURAL

3. Do you live on the property that includes the current or potential beaver site?

   ☐ YES, ALL YEAR-ROUND

   ☐ YES, ONLY SEASONALLY

   ☐ NO, I LIVE ELSEWHERE, BUT A TENANT LIVES ON THE PROPERTY

   ☐ NO, I LIVE ELSEWHERE AND NO ONE LIVES ON THE PROPERTY

4. Please indicate the approximate number of acres of the property that are included in each of the following land types. (If none, write in zero (0).)

Acres	Land Type
____	HOME SITE, LAWN, OUT-BUILDINGS
____	WOODLANDS
____	PASTURE OR OPEN LAND
____	CROPS, INCLUDING HAY
____	PONDS, STREAMS, SEASONALLY FLOODED OR MARSHY AREAS
____	IDLE FIELDS OR BRUSHY AREAS
____	OTHER: PLEASE SPECIFY_____

5. On the list below, mark all primary uses of this property, then circle the <u>one</u> most important property use. (Mark only primary uses.)

   ☐ HOME SITE OR DWELLING

   ☐ FARM - CASH CROPS

   ☐ FARM - LIVESTOCK

   ☐ FARM - ORCHARD

   ☐ TIMBER PRODUCTS

   ☐ PRIVATE RECREATION USE

   ☐ OTHER: PLEASE SPECIFY_____

** REMEMBER, CIRCLE THE <u>ONE</u> MOST IMPORTANT USE ABOVE**

6. Have you seen any evidence that beaver have been active on the property during the period from 1982 to the present?

☐ YES

☐ NO--IF NO, SKIP TO QUESTION 15

7. In which years, from 1982 to the present, have you seen evidence of beaver on the property? (Mark all that apply.)

☐ I SAW EVIDENCE OF BEAVER IN 1982

☐ I SAW EVIDENCE OF BEAVER IN 1983

☐ I SAW EVIDENCE OF BEAVER IN 1984

8. Again considering the period from 1982 to the present, how much of the property is flooded or covered by water because of beaver in an average year? (If less than 1 acre, indicate portion of acre such as 1/2, 1/3, etc.)

BEAVERS FLOOD AN AVERAGE OF ABOUT ____ ACRES ANNUALLY

BEAVER DAMAGE

9. Have you ever experienced nuisance problems or damage resulting from beaver on the property?

☐ YES

☐ NO--SKIP TO QUESTION 15

10. In which of the following years have you experienced beaver damage on the property? (Mark all that apply.)

☐ I EXPERIENCED DAMAGE IN 1982

☐ I EXPERIENCED DAMAGE IN 1983

☐ I EXPERIENCED DAMAGE IN 1984

☐ I HAVE NOT EXPERIENCED ANY DAMAGE ON MY PROPERTY FROM 1982 TO THE PRESENT--SKIP TO QUESTION 15.

11. In general, how would you describe the amount of beaver damage to the property from 1982 to the present? (Mark one.)

☐ LIGHT DAMAGE

☐ MODERATE DAMAGE

☐ SEVERE DAMAGE

12. Please write in below a brief description of each type of damage on the property caused by beaver (such as damage to timber, crops, structures, etc.) from 1982 to the present. Also, for each damage incident please make your best estimate of:

(1) the dollar value of any loss incurred,

(2) your personal "out-of-pocket" expenses for repair or control of damage, and

(3) the number of days spent to repair the damage and/or to control the beaver, such as trapping, to prevent further damage (count any part of a day spent as a whole day).

Type of Beaver Damage (from 1982 to present)	(1) Estimate of Damage	(2) Personal Expenses for Repair or Control	(3) Days Spent for Repair or Control
_____	$_____	_____	___
_____	$_____	_____	___
_____	$_____	_____	___
_____	$_____	_____	___

13. Which of the statements below best describes your feelings about the amount of damage the property received from beaver from 1982 to the present?

☐ THE AMOUNT OF DAMAGE WAS UNREASONABLE

☐ THE AMOUNT OF DAMAGE WAS TOLERABLE

14a. If you experienced beaver damage on the property from 1982 to the present, what steps did you take to control the damage? (Mark all that apply.)

☐ NONE

☐ CONTACTED DEPARTMENT OF ENVIRONMENTAL CONSERVATION FOR BEAVER CONTROL INFORMATION

☐ CONTACTED DEPARTMENT OF ENVIRONMENTAL CONSERVATION FOR BEAVER REMOVAL PERMIT

☐ REQUESTED THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION TO REMOVE THE BEAVER

☐ PERSONALLY TRAPPED BEAVER

☐ ALLOWED OTHERS TO TRAP BEAVER

☐ REMOVED THE BEAVER, BUT NOT BY TRAPPING

☐ ATTEMPTED TO CONTROL DAMAGE WITHOUT REMOVING ANY BEAVER FROM THE SITE

☐ OTHER--PLEASE DESCRIBE

(i)_____

(ii)_____

14b. If you contacted the Department of Environmental Conservation (DEC) about beaver damage, were you satisfied with the response you received?

☐ DID NOT CONTACT DEC ABOUT DAMAGE

☐ YES

☐ NO--WHY NOT?_____

_____

15. Have any of your neighboring landowners with property adjoining yours ever been affected by the beaver site on your property?

- ☐ YES
- ☐ NO
- ☐ DON'T KNOW

16. To the best of your knowledge, what are the adjoining landowner's general feelings about beaver? (Mark one.)

- ☐ THEY GENERALLY FAVOR THE PRESENCE OF BEAVER
- ☐ THEY ARE GENERALLY OPPOSED TO THE PRESENCE OF BEAVER
- ☐ THEY GENERALLY DO NOT CARE ONE WAY OR ANOTHER ABOUT BEAVER
- ☐ THEY HAVE NOT YET FORMED AN OPINION ABOUT BEAVER
- ☐ I DON'T KNOW THEIR FEELINGS ABOUT BEAVER

17. If you were provided technical information or instructions, would you be willing to make your property less attractive for beaver in order to prevent future beaver damage problems?

- ☐ YES
- ☐ NO--WHY NOT?_____

18. If beavers were to cause damage on the property (for instance, flooding caused by the presence of a beaver dam), what type of land or structure would most likely be affected? First, mark all that may be affected, then circle the one item you marked where controlling any damage would be most important to you.

- ☐ DON'T KNOW
- ☐ HOMESITE, LAWN, OR OUT-BUILDINGS
- ☐ WOODLANDS
- ☐ PASTURE OR OPEN LAND
- ☐ CROPS, INCLUDING HAY
- ☐ PONDS, STREAMS, OR MARSHY AREAS
- ☐ IDLE FIELDS OR BRUSHY AREAS
- ☐ ACCESS ROADS
- ☐ COMMERCIAL BUILDINGS
- ☐ RECREATION CAMP PROPERTIES
- ☐ OTHER: PLEASE SPECIFY_____

_____

* REMEMBER, CIRCLE THE ONE ITEM THAT YOU'VE MARKED ABOVE WHERE CONTROLLING ANY BEAVER DAMAGE WOULD BE MOST IMPORTANT TO YOU. *

--IF NONE ARE IMPORTANT, MARK HERE ☐ AND CONTINUE--

ATTITUDES ABOUT BEAVER

19. What recreational uses do you have now, or would you have for a wetland created by beaver on your property? (Mark all that are appropriate.)

- ☐ NONE
- ☐ NATURE/WILDLIFE OBSERVATION
- ☐ FISHING
- ☐ TRAPPING
- ☐ HUNTING
- ☐ OTHER: PLEASE DESCRIBE

_____

_____

20. Generally, how do/would you feel about having beaver on your property? (Mark one only.)

- ☐ MOST PROBLEMS THAT BEAVERS CAUSE ARE TOLERABLE BECAUSE I ENJOY HAVING THEM AROUND.
- ☐ I CAN ENJOY A FEW BEAVER, BUT I WORRY ABOUT THEM CAUSING DAMAGE.
- ☐ I GENERALLY THINK OF BEAVER AS A NUISANCE; I CAN GET ALONG WITHOUT ANY BEAVER ON MY PROPERTY.
- ☐ IT DOES NOT MATTER TO ME WHETHER BEAVER ARE ON MY PROPERTY OR NOT.

21. Please indicate below whether you would prefer the Department of Environmental Conservation to increase, decrease, or leave beaver populations at their current levels in the town where your property is located. (Mark one only.)

- ☐ GREATLY INCREASE BEAVER POPULATIONS
- ☐ MODERATELY INCREASE BEAVER POPULATIONS
- ☐ SLIGHTLY INCREASE BEAVER POPULATIONS
- ☐ MAINTAIN CURRENT LEVELS OF BEAVER POPULATIONS
- ☐ SLIGHTLY DECREASE BEAVER POPULATIONS
- ☐ MODERATELY DECREASE BEAVER POPULATIONS
- ☐ GREATLY DECREASE BEAVER POPULATIONS

22. What changes, if any, have you noticed in the last 5 years in the beaver population in the town where your property is located?

- ☐ THERE ARE MORE BEAVER NOW
- ☐ THERE ARE ABOUT THE SAME NUMBER OF BEAVERS
- ☐ THERE ARE FEWER BEAVERS NOW
- ☐ I DON'T KNOW HOW THE POPULATION HAS CHANGED

23. The following statements reflect various attitudes toward beaver. Please indicate how you feel about the following by your agreement or disagreement with each statement. (Indicate your response for each statement by marking the appropriate category.)

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
I do/would like to talk about beavers with family or friends.	( )	( )	( )	( )	( )
I do/would enjoy observing or photographing beavers.....	( )	( )	( )	( )	( )
I can/could tolerate most beaver nuisance problems.....	( )	( )	( )	( )	( )
I do/would enjoy trapping beavers for the sale of furs or pelts.....	( )	( )	( )	( )	( )
I consider the presence of beavers to be a sign of the quality of the natural environment.....	( )	( )	( )	( )	( )
I can/could tolerate most levels of property damage by beaver.....	( )	( )	( )	( )	( )
I do/would express my opinions about beaver and their management to public officials or to officers of private conservation organizations.....	( )	( )	( )	( )	( )
I enjoy knowing that beavers exist in nature.....	( )	( )	( )	( )	( )

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
I can/could tolerate the ordinary risk of beaver transmitting disease to humans or domestic animals.....	( )	( )	( )	( )	( )
I think that local economies should benefit from the sale of equipment, supplies, or services related to trapping of beaver.....	( )	( )	( )	( )	( )
I appreciate the role that beaver play in the natural environment.....	( )	( )	( )	( )	( )
I enjoy beaver for their educational value; they teach us more about nature....	( )	( )	( )	( )	( )
I think it is important to manage beaver for an annual harvest for human use without harming the future of the beaver population.....	( )	( )	( )	( )	( )
I do/would like to understand the reasons that beaver behave as they do.....	( )	( )	( )	( )	( )
I think that the wetland areas created by beaver are important to the natural environment.....	( )	( )	( )	( )	( )

24. From which of the following information sources would you like to obtain information about beavers and control of beaver damage? (Mark all that apply.)

- ☐ COUNTY COOPERATIVE EXTENSION AGENT
- ☐ NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION'S "THE CONSERVATIONIST" MAGAZINE
- ☐ OTHER DEC PUBLICATIONS OR PAMPHLETS
- ☐ FARM ORGANIZATIONS (GRANGE, FARM BUREAU)
- ☐ U.S. SOIL CONSERVATION SERVICE (ALSO ASCS AND OTHER FEDERAL CONSERVATION ORGANIZATIONS)
- ☐ NEWSPAPERS
- ☐ RADIO
- ☐ OTHER: PLEASE SPECIFY_____

_____

PERSONAL INFORMATION

The following information will be kept strictly confidential and is never associated with your name.

25. What is your sex?

- ☐ FEMALE
- ☐ MALE

26. What is your age? _____

THANK YOU FOR YOUR TIME AND EFFORT.

TO RETURN THIS QUESTIONNAIRE, simply seal it and deposit in any mailbox. The postage has been provided.

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 878 ITHACA, N.Y.

POSTAGE WILL BE PAID BY ADDRESSEE

CORNELL UNIVERSITY
Natural Resources, K. Purdy & D. Decker
P.O. Box DH
Ithaca, New York 14851-9978

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

APPENDIX B

Cover and Follow-up Letters for Site-owner Survey

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

Department of Natural Resources
Fernow Hall, Ithaca, N. Y. 14853-0188

Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy
and Planning
Aquatic Science

January 29, 1985

Dear Landowner:

The New York State Department of Environmental Conservation is updating its beaver management program in Central New York. As part of this effort, Cornell University has been asked to determine the interests and concerns of landowners who may be affected by beaver.

Through the use of aerial photographs, your Central New York property has been identified as containing a site that beaver are either currently occupying or may potentially occupy if beaver were to move into the area. As such a property owner, your views are extremely important. By answering the enclosed questionnaire you can make your opinions known to DEC wildlife managers.

To report accurately the feelings of landowners in Central New York, we need a completed questionnaire from everyone surveyed. We want your reply even if you do not have any concerns about beaver on your property at this time. Simply complete the questionnaire, seal it, and drop it in the mail; postage has been provided. All information you provide will be kept confidential and is never associated with your name.

Thank you for your assistance.

Sincerely,

Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k
enclosure

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

Department of Natural Resources
Fernow Hall, Ithaca, N. Y. 14853-0188

Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy
and Planning
Aquatic Science

February 5, 1985

Dear Landowner:

About a week ago we sent you a tan-colored questionnaire entitled "Central New York Beaver Management Survey." If you have already returned the questionnaire, please accept our sincerest thanks. If you have not yet had an opportunity to complete your questionnaire, please take a few minutes to complete it today and send it back to us so that your information can be processed as soon as possible.

Please understand that your response is extremely important to the success of this survey. Your answers, in addition to those of other landowners in Central New York, will help determine how your concerns about beaver may be served best through improved management.

All the information you provide will be kept confidential and will not be associated with your name. To return the questionnaire, simply seal it and drop it in the mail; return postage is provided.

Sincerely,

Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

Department of Natural Resources
Fernow Hall, Ithaca, N. Y. 14853-0188

Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy and Planning
Aquatic Science

February 14, 1985

Dear Landowner:

About three weeks ago we sent you a questionnaire regarding your interests and concerns about beaver management in your area. To date, we have not received your reply. If you have not completed the questionnaire, we would like to urge you to take a few minutes now to do so.

It is important that we receive your reply even if you have no concerns about beaver. Your response is necessary to help us assess accurately landowners' opinions about beaver. Your answers are strictly confidential and will not be associated with your name.

In case you misplaced the first questionnaire, another is enclosed. Return postage has been provided; just seal the completed questionnaire and drop it in the mail.

Thank you for your assistance.

Sincerely,

Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k
enclosure

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

Department of Natural Resources
Fernow Hall, Ithaca, N. Y. 14853-0188

Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy
and Planning
Aquatic Science

February 21, 1985

Dear Landowner:

We still have not received your completed questionnaire concerning your opinions of beaver management. It is important that we receive your reply to insure that the interests of landowners are provided for.

Please complete and return the questionnaire today; return postage has been provided. Your answers are confidential and are never associated with your name.

Sincerely,

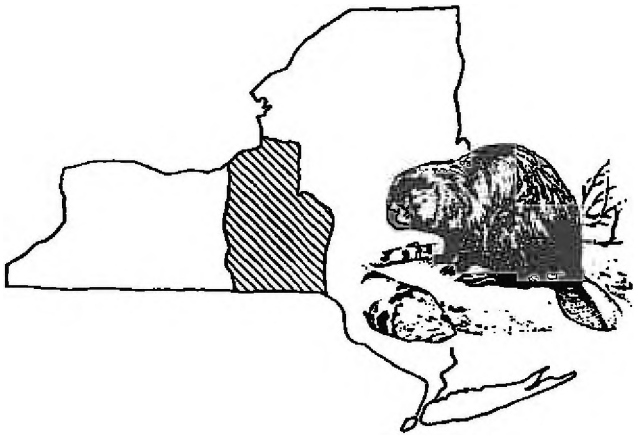
Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k

CENTRAL NEW YORK BEAVER MANAGEMENT SURVEY

Highway Superintendent Opinions



CENTRAL NEW YORK
BEAVER MANAGEMENT SURVEY

Conducted by the
Department of Natural Resources
in the State College of
Agriculture and Life Sciences
Cornell University

This survey is being conducted to determine the concerns, interests, and opinions of Highway Superintendents of Central New York regarding beaver management. The New York State Department of Environmental Conservation has asked us to obtain this information for purposes of updating beaver management programs in your area. The following brief questions give you an opportunity to express your opinions.

We would like the addressee (or current Town Highway Superintendent) to complete this questionnaire as soon as possible, seal it, and simply drop it in the mail; return postage is provided. Your answers will remain confidential. Your assistance with this survey is critical to the development of beaver management plans that consider your needs and concerns.

THANK YOU FOR YOUR COOPERATION.

APPENDIX C

Mail Questionnaire, Cover and Follow-up Letters for Highway Superintendent Survey

YOUR JOB AND BEAVER

Highway Superintendents throughout New York sometimes experience nuisance problems or damage to roads and other structures resulting from the activities of beaver. The following questions refer to beaver problems that you may have dealt with as a Highway Superintendent and the measures taken to control such problems.

1. How many years have you served as a Highway Superintendent? (If less than 1 year, write in the number of months served.)

   ☐ YEARS OR ☐ MONTHS--INDICATE MONTHS ONLY IF POSITION HELD LESS THAN 1 YEAR.

2. Considering the last 3 years, what overall trend have you experienced in the number of beaver-related problems in your jurisdiction that your town has had to respond to?

   ☐ THE NUMBER OF BEAVER-RELATED PROBLEMS SEEMS TO BE INCREASING IN RECENT YEARS.

   ☐ THE NUMBER OF BEAVER-RELATED PROBLEMS SEEMS ABOUT THE SAME FROM YEAR TO YEAR.

   ☐ THE NUMBER OF BEAVER-RELATED PROBLEMS SEEMS TO BE DECREASING IN RECENT YEARS.

   ☐ DON'T KNOW.

3. Again considering the last 3 years, at how many locations in your jurisdiction are roads or other structures damaged by beaver in an "average year"? (If none, write in a zero.)

   ☐ AVERAGE NUMBER OF ANNUAL BEAVER DAMAGE LOCATIONS IN MY JURISDICTION

   (IF 0 OR NONE, SKIP TO QUESTION 9)

4. Please list below the types of beaver damage problems you typically deal with in your jurisdiction (such as highway or culvert flooding), then circle the one problem you believe to be most important overall.

   TYPES OF BEAVER DAMAGE

   (a)_____

   (b)_____

   (c)_____

   (d)_____

   * REMEMBER, CIRCLE THE ONE MOST IMPORANT TYPE OF PROBLEM ABOVE. *

5. Please write in below:
   (a) brief descriptions of the 3 to 4 most recent beaver-related damage problems you have dealt with,

   (b) your best estimates of the man-days, if any, spent repairing the damage or correcting the problem, and

   (c) your best estimates of the costs, including labor and other costs, involved in damage repair or correction of the problem.

   NOTE—If no man-days or no costs for repair, write in a 0.

Type of Beaver Damage	Man-days for Repair	Total Costs for Repair
_____	___	$_____
_____	___	$_____
_____	___	$_____
_____	___	$_____

6. What actions do you usually take to prevent beaver damage from recurring? (Check all that apply.)

- ☐ NONE--JUST REPAIR OF DAMAGED STRUCTURE(S)
- ☐ CONTACT DEPARTMENT OF ENVIRONMENTAL CONSERVATION (DEC) FOR BEAVER CONTROL INFORMATION
- ☐ CONTACT DEC FOR BEAVER REMOVAL PERMIT
- ☐ REGULAR MAINTENANCE OF LIKELY BEAVER PROBLEM AREAS
- ☐ REQUEST DEC TO REMOVE THE BEAVER
- ☐ REMOVE THE BEAVER OURSELVES
- ☐ CONTACT OR HIRE OTHERS TO REMOVE BEAVER
- ☐ ALTER THE ROAD OR OTHER STRUCTURE DESIGN TO DISCOURAGE FUTURE BEAVER PROBLEMS
- ☐ OTHER--PLEASE DESCRIBE:

(a)_____

(b)_____

7. Overall, have you been satisfied with assistance from the Department of Environmental Conservation (DEC) when dealing with beaver damage in your jurisdiction?

- ☐ HAVE NEVER REQUESTED ASSISTANCE OF DEC
- ☐ YES
- ☐ NO--WHY NOT?_____

_____

_____

8. In general, how do you feel about the beaver problems you deal with in your jurisdiction? (Mark one only.)

- ☐ THE PROBLEMS THAT BEAVER CAUSE TO ROADS AND OTHER STRUCTURES ARE GENERALLY TOLERABLE
- ☐ BEAVERS CAUSE UNREASONABLE AMOUNTS OF DAMAGE TO ROADS AND OTHER STRUCTURES

9. Which of the following, if any, types of assistance would you like to receive from the Department of Environmental Conservation regarding control of beaver damage problems? (Mark all that apply.)

- ☐ TECHNICAL ASSISTANCE (SUCH AS INFORMATIVE PAMPHLETS ILLUSTRATING METHODS OF CONTROL)
- ☐ COOPERATIVE DAMAGE CONTROL (WHEREBY DEC PROVIDES CONTROL DEVICE, SUCH AS MODIFIED ROAD CULVERTS, AND YOUR DEPARTMENT PROVIDES INSTALLATION AND ANNUAL MAINTENANCE)
- ☐ IN-SERVICE TRAINING/DEMONSTRATIONS OF BEAVER CONTROL TECHNIQUES FOR YOUR CREWS
- ☐ ON-SITE ADVICE AND/OR ASSISTANCE FOR INSTALLATION OF CONTROL DEVICE
- ☐ TECHNICAL ASSISTANCE TO ENSURE THAT HIGHWAY ALTERATIONS/IMPROVEMENTS WILL BE DESIGNED TO DISCOURAGE FUTURE BEAVER PROBLEMS
- ☐ NONE

10. From your standpoint as a highway superintendent, please indicate below whether you would like to see beaver populations in your district increase, decrease, or remain at current levels. (Mark one.)

- ☐ GREATLY INCREASE BEAVER POPULATIONS
- ☐ MODERATELY INCREASE BEAVER POPULATIONS
- ☐ SLIGHTLY INCREASE BEAVER POPULATIONS
- ☐ MAINTAIN CURRENT LEVELS OF BEAVER POPULATIONS
- ☐ SLIGHTLY DECREASE BEAVER POPULATIONS
- ☐ MODERATELY DECREASE BEAVER POPULATIONS
- ☐ GREATLY DECREASE BEAVER POPULATIONS

11a. Is any part of your annual budget request specified for dealing with beaver damage?

- ☐ YES
- ☐ NO--SKIP TO QUESTION 12.

11b. If you do make budget requests for beaver damages, how does your town board react?

- ☐ USUALLY SUPPORTS REQUEST
- ☐ USUALLY OPPOSES REQUEST

PERSONAL ATTITUDES ABOUT BEAVER

12. The following statements reflect various personal attitudes toward beaver. Please indicate how you feel about the following by your agreement or disagreement with each statement. (Indicate your response for each statement by marking the appropriate category.)

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
I can/could tolerate most levels of property damage by beaver.....	( )	( )	( )	( )	( )
I do/would express my opinions about beaver and their management to public officials or to officers of private conservation organizations.....	( )	( )	( )	( )	( )
I enjoy knowing that beavers exist in nature.....	( )	( )	( )	( )	( )
I do/would like to talk about beavers with family or friends.	( )	( )	( )	( )	( )
I do/would enjoy observing or photographing beavers.....	( )	( )	( )	( )	( )
I can/could tolerate most beaver nuisance problems.....	( )	( )	( )	( )	( )
I do/would enjoy trapping beavers for the sale of furs or pelts.....	( )	( )	( )	( )	( )

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
I consider the presence of beavers to be a sign of the quality of the natural environment.....	( )	( )	( )	( )	( )
I can/could tolerate the ordinary risk of beaver transmitting disease to humans or domestic animals.....	( )	( )	( )	( )	( )
I think that local economies should benefit from the sale of equipment, supplies, or services related to trapping of beaver..	( )	( )	( )	( )	( )
I appreciate the role that beaver play in the natural environment.....	( )	( )	( )	( )	( )
I enjoy beaver for their educational value; they teach us more about nature.....	( )	( )	( )	( )	( )
I think it is important to manage beaver for an annual harvest for human use without harming the future of the beaver population.....	( )	( )	( )	( )	( )
I do/would like to understand the reasons that beaver behave as they do.....	( )	( )	( )	( )	( )
I think that the wetland areas created by beaver are important to the natural environment.....	( )	( )	( )	( )	( )

13. Do you currently own property that has beaver on it?

☐ YES

☐ NO--SKIP TO QUESTION 16

☐ NOT SURE IF BEAVER ARE ON MY PROPERTY OR NOT--SKIP TO QUESTION 16

14. Have you ever experienced nuisance problems or damage resulting from beaver on your property?

☐ YES

☐ NO--SKIP TO QUESTION 16

15. Which one statement below best describes your feelings about the amount of damage your property received from beaver?

☐ THE AMOUNT OF DAMAGE WAS UNREASONABLE

☐ THE AMOUNT OF DAMAGE WAS TOLERABLE

16. What are your **primary** uses of your property? (Mark only primary uses.)

- ☐ HOME SITE OR DWELLING
- ☐ FARM - CASH CROPS
- ☐ FARM - LIVESTOCK
- ☐ FARM - ORCHARD
- ☐ TIMBER PRODUCTS
- ☐ PRIVATE RECREATION USE
- ☐ OTHER--PLEASE SPECIFY:_____

17. Which of the following recreational uses would you have for a beaver-created wetland? (Mark all that apply.)

- ☐ NONE
- ☐ NATURE/WILDLIFE OBSERVATION
- ☐ FISHING
- ☐ TRAPPING
- ☐ HUNTING
- ☐ OTHER--DESCRIBE:_____

18. How do you personally feel about having beaver in your town? (Mark one.)

- ☐ MOST PROBLEMS THAT BEAVER CAUSE ARE TOLERABLE BECAUSE I ENJOY HAVING THEM AROUND.
- ☐ I CAN ENJOY A FEW BEAVER, BUT I WORRY ABOUT THEM CAUSING DAMAGE.
- ☐ I GENERALLY THINK OF BEAVER AS A NUISANCE; I COULD GET ALONG WITHOUT ANY BEAVER.
- ☐ IT DOES NOT MATTER WHETHER BEAVER ARE IN MY TOWN OR NOT.

19. Other comments or suggestions can be provided in the space below.

THANK YOU FOR YOUR TIME AND EFFORT.

TO RETURN THIS QUESTIONNAIRE, simply fold and seal it and deposit it in a mailbox. Postage has been provided.

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 876 ITHACA, N.Y.

POSTAGE WILL BE PAID BY ADDRESSEE

CORNELL UNIVERSITY
Natural Resources, K. Purdy & D. Decker
P.O. Box DH
Ithaca, New York 14851-9978

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

Department of Natural Resources
Fernow Hall, Ithaca, N. Y. 14853-0188

Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy
and Planning
Aquatic Science

January 10, 1985

Dear Town Highway Superintendent:

The New York State Department of Environmental Conservation is updating its beaver management program in Central New York. As part of this effort, we at Cornell University have been asked to determine the interests and concerns of Town Highway Superintendents who may be affected by beaver.

Your occupational needs and problems related to beaver are being surveyed in order to better understand how your interests can be served through beaver management. By answering the enclosed questionnaire you can make your opinions known.

To report accurately the feelings of Town Highway Superintendents in Central New York, we need a completed questionnaire from everyone surveyed. We want your reply even if you do not have any concerns about beaver in your town at this time. Simply complete the questionnaire, fold and seal it, and drop it in the mail; postage has been provdied. All information you provide will be kept confidential and is never associated with your name.

Thank you for your assistance.

Sincerely,

Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k
enclosure

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

Department of Natural Resources
Fernow Hall, Ithaca, N. Y. 14853-0188

Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy
and Planning
Aquatic Science

January 22, 1985

Dear Town Highway Superintendent:

About a week ago we sent you a tan-colored questionnaire entitled "Central New York Beaver Management Survey." If you have already returned the questionnaire, please accept our sincerest thanks. If you have not yet had an opportunity to complete your questionnaire, please take a few minutes to complete it today and send it back to us so that your information can be processed as soon as possible.

Please understand that your response is extremely important to the success of this survey. Your answers, in addition to those of other Town Highway Superintendents in Central New York, will help determine how your concerns about beaver may be served best through improved management.

All the information you provide will be kept confidential and will not be associated with your name. To return the questionnaire, simply seal it and drop it in the mail; return postage is provided.

Sincerely,

Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k

New York State College of Agriculture and Life Sciences
a Statutory College of the State University
Cornell University

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Fernow Hall, Ithaca, N. Y. 14853-0188

Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy
and Planning
Aquatic Science

January 29, 1985

Dear Town Highway Superintendent:

About three weeks ago we sent you a questionnaire regarding your interests and concerns about beaver management in your town. To date, we have not received your reply. If you have not completed the questionnaire, we would like to urge you to take a few minutes now to do so.

It is important that we receive your reply even if you have no concerns about beaver. Your response is necessary to help us assess accurately Town Highway Superintendent's opinions about beaver. Your answers are strictly confidential and will not be associated with your name.

In case you misplaced the first questionnaire, another is enclosed. Return postage has been provided; just seal the completed questionnaire and drop it in the mail.

Thank you for your assistance.

Sincerely,

Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k
enclosure

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Fishery Science
Forest Science
Wildlife Science
Natural Resources
Resource Policy
and Planning
Aquatic Science

February 5, 1985

Dear Town Highway Superintendent:

We still have not received your completed questionnaire concerning your opinions of beaver management. It is important that we receive your reply to insure that the interests of Town Highway Superintendents are provided for.

Please complete and return the questionnaire today; return postage has been provided. Your answers are confidential and are never associated with your name.

Sincerely,

Ken G. Purdy
Research Support Specialist
Natural Resources

Daniel J. Decker
Research Associate
and
Wildlife Extension Specialist
Natural Resources

KGP/DJD:k

APPENDIX D

Nonrespondent Follow-up Questionnaire for Inactive Site-owner Nonrespondents

1984 BEAVER DAMAGE SURVEY:

NONRESPONDENT FOLLOW-UP TELEPHONE INTERVIEW

Mail Survey ID#_____ Site Type_____ Phone #_____ Date:__/__/__

Hello, my name is _____, I work for the Department of Natural Resources at Cornell University. May I speak to _____?

(If person who answers is who you seek, continue. If not, when they do come to the phone, repeat introduction and continue.)

(If person is unavailable; ask:) When may I call back to reach him/her? ____a.m.
____p.m.
_____date

I am calling you with regard to a wildlife survey about beaver management that we mailed to you recently. We are trying to recontact people who were unable to respond to the questionnaire so that we may obtain enough information to improve beaver management policies in Central New York.

May I take about 3 minutes of your time to ask these few questions?

___YES -- Continue

___NO -- If no, thank respondent and terminate interview.

We have used aerial photographs to determine locations of wetland sites that are currently occupied by beaver or have the potential to become occupied if beaver move into the area. These sites are typically stream drainages, ponds, or other wetlands. Property records indicate that you own, in whole or in part, such a wetlands site.

1. Do you think you know which property of yours has a site that beaver

   (a) are currently occupying (READ THIS IF SITE TYPE = ACTIVE)

   (b) have previously occupied and might <u>potentially</u> return to in the future? (READ THIS IF SITE TYPE = POTENTIAL)

___YES

___NO ┐
___UNCERTAIN ┘ SKIP TO QUESTION 7

2. How would you describe the area where that property is located? Is it: (READ)

___URBAN

___SUBURBAN

___RURAL

3. What is the one most important use of that property? (Do not read, just mark appropriate category.)

___HOME SITE OR DWELLING

___FARM - CASH CROPS

___FARM - LIVESTOCK

___FARM - ORCHARD

___TIMBER PRODUCTS

___PRIVATE RECREATION USE

___OTHER: SPECIFY_____

4. Have you seen any evidence that beaver have been active on the property during the period from 1982 to the present?

___YES

___NO -- IF NO, SKIP TO QUESTION 7.

5. Have you ever experienced nuisance problems or damage resulting from beaver on the property?

___YES

___NO -- IF NO, SKIP TO QUESTION 7.

6. How would you describe your feelings about the amount of damage the property received from beaver from 1982 to the present? Would you say: (READ)

___THE AMOUNT OF DAMAGE WAS UNREASONABLE

___THE AMOUNT OF DAMAGE WAS TOLERABLE

7. How would you describe the way you do/would feel about having beaver on your property? Would you say that: (READ)

___MOST PROBLEMS THAT BEAVERS CAUSE ARE TOLERABLE BECAUSE I ENJOY HAVING THEM AROUND.

___I CAN ENJOY A FEW BEAVER, BUT I WORRY ABOUT THEM CAUSING DAMAGE.

___I GENERALLY THINK OF BEAVER AS A NUISANCE; I CAN GET ALONG WITHOUT ANY BEAVER ON MY PROPERTY.

___IT DOES NOT MATTER TO ME WHETHER BEAVER ARE ON MY PROPERTY OR NOT.

8. Would you prefer the Department of Environmental Conservation to increase, decrease, or leave beaver populations at their current levels in the town where your property is located?

___INCREASE ___STAY SAME ___DECREASE

Would you prefer this increase to be: (READ)

___Slight

___Moderate

___Large

Would you prefer this decrease to be: (READ)

___Slight

___Moderate

___Large

**THANK YOU VERY MUCH FOR YOUR TIME AND INFORMATION.

APPENDIX E

Estimated Number of Beaver Sites in Region 7 and Response Weight Calculations, by Sampling Strata

Estimated Number of[1] Beaver Sites in Region 7 and Response Weight Calculations, by Sampling Strata.

Sampling Strata	# Beaver Sites in Region 7	Proportion of Sites	# Responses per Strata	Proportion of Responses per Strata	Weights
Active/complaint sites	150	0.02551	176	0.41607	0.85227
Active/noncomplaint sites	785	0.13353	109	0.25768	7.20183
Inactive sites	4944	0.84096	138	0.32624	35.82609
Totals	5879	1.00000	423	1.00000	N/A

[1]Estimates based on Region 7 beaver survey data for 1983.

APPENDIX F

Detailed Findings of the Beaver Damage Tolerance Survey of Town and County Highway Superintendents

Appendix F (continued)

Table F-1. Number of Locations of Beaver Damage Reported by Region 7 Highway Superintendents in an "Average Year."

Number of Damage Locations per Superintendant	Percent of Superintendents									
	All Counties (N=120)	Broome (N=14)	Cayuga (N=16)	Chenango (N=20)	Cortland (N=11)	Madison (N=15)	Onondaga (N=12)	Oswego (N=19)	Tioga (N=8)	Tompkins (N=5)
0	52	72	56	30	64	47	67	32	62	80
1-2	25	14	19	55	18	33	17	10	37	0
3-5	17	14	6	15	18	20	8	42	0	20
6+	6	0	19	0	0	0	8	16	0	0
Totals	100	100	100	100	100	100	100	100	100	100
Mean	1.4	0.8	1.7	1.3	0.9	1.3	1.1	2.6	0.6	0.6

Table F-2. Types of Beaver Damage Problems Typically Encountered by Highway Superintendents in Region 7 and Those Problems Perceived to be Most Important.

Damage Type	Percent	
	Typically Encountered (N=99)[1]	Most Important (N=52)[2]
Drainage culverts (obstructed)	48.5	57.7
Road surface erosion	38.4	38.3
Trees on road	5.0	0.0
Other structural damage	2.0	2.0
Other	6.1	2.0
	100.0	100.0

[1] N refers to number of responses (i.e., multiple response).

[2] N refers to number of individuals (i.e., single response).

Table F-3. Average Man-Days of Effort and Repair Costs Reported by Highway Superintendents per Incidence of Beaver Damage Reported.

Type of Damage	N	Average per Repair Effort	
		Man-Days	Total Expenses
Culvert damage	34	18.5	$2,201.35
Road surface erosion	4	5.8	$1,603.75
All types (aggregate)	38	12.1	$1,902.55

Table F-4. Usual Actions Taken by Highway Superintendents to Prevent Beaver Damage for Recurring by County.[1]

Preventative Action	Percent Reporting Action Taken[2]									
	All Counties (N=58)	Broome (N=3)	Cayuga (N=8)	Chenango (N=14)	Cortland (N=3)	Madison (N=8)	Onondaga (N=4)	Oswego (N=13)	Tioga (N=3)	Tompkins (N=2)
None - just repair of damage	21	0	0	14	33	12	75	31	0	50
Contact DEC for beaver control information	43	67	25	29	67	62	50	61	0	0
Contact DEC for beaver removal permit	50	33	50	57	33	50	25	69	33	0
Regular maintenance of problem sites	43	100	25	36	33	37	50	69	0	0
Request DEC to remove beaver	50	100	87	43	67	25	50	46	0	50
Superintendent removes beaver	9	0	12	7	33	0	0	15	0	0
Hire others to remove beaver	15	33	0	14	0	37	0	23	0	0
Modify road/structure design	29	67	12	14	67	0	50	54	33	0

[1]Responses provided by superintendents reporting beaver damage.

[2]Multiple Response (percentages are rounded to nearest whole number).

Table F-5. Relationship of the Number of Annual Damage Sites Experienced by Highway Superintendents to Usual Damage Prevention Actions.

Preventative Action	Percent by Number of Annual Damage Sites[1]			Mean Number of Damage Sites
	1-2	3-4	5+	
None - just repair of damage	17.9	11.1	40.0	3.3
Contact DEC for beaver control information	42.9	50.0	40.0	3.8
Contact DEC for beaver removal permit	32.1	66.7	80.0	3.6
Regular maintenance of problem sites	35.7	61.1	40.0	3.0
Request DEC to remove beaver	42.9	44.4	80.0	3.3
Superintendant removes beaver	3.6	11.1	20.0	4.6
Hire others to remove beaver	10.7	22.0	20.0	3.2
Modify road/structure design	14.3	50.0	40.0	3.7

[1]Percents refer to respondents answering each prevention option affirmatively.

Table F-6. Relationship of Years of Occupational Experience to Usual Actions Taken by Highway Superintendents to Prevent Beaver Damage from Recurring.

Preventative Action	Percent by Years of Experience[1]			Mean Years of Experience
	1-2 yrs.	3-5 yrs.	6+ yrs.	
None - just repair of damage	30.0	26.7	15.6	5.6
Contact DEC for beaver control information	50.0	33.3	46.9	7.4
Contact DEC for beaver removal permit	60.0	53.3	46.9	7.1
Regular maintenance of problem sites	20.0	46.7	46.9	8.6
Request DEC to remove beaver	50.0	40.0	53.1	7.4
Superintendant removes beaver	20.0	6.7	6.3	4.4
Hire others to remove beaver	10.0	20.0	15.6	9.4
Modify road/structure design	30.0	33.3	25.0	7.1

[1]Percents refer to respondents answering each prevention option affirmatively.

Table F-7. Satisfaction with Request to DEC for Beaver Damage Control Information/Assistance Among Highway Superintendents Reporting Damage.

Satisfied with Information/Assistance	Percent of Superintendents									
	All Counties (N=50)	Broome (N=4)	Cayuga (N=8)	Chenango (N=12)	Cortland (N=2)	Madison (N=7)	Onondaga (N=3)	Oswego (N=11)	Tioga (N=2)	Tompkins (N=1)
Yes	58	75	37	83	50	43	33	55	100	0
No	42	25	63	17	50	57	67	45	0	100
Totals	100	100	100	100	100	100	100	100	100	100

Table F-8. Types of Beaver Damage Control Assistance Desired by Highway Superintendents with Beaver Damage Experience.

Assistance Type Desired	Percent of Superintendents[1]									
	All Counties (N=60)	Broome (N=4)	Cayuga (N=7)	Chenango (N=14)	Cortland (N=5)	Madison (N=7)	Onondaga (N=5)	Oswego (N=12)	Tioga (N=3)	Tompkins (N=3)
None	22	0	29	14	60	29	20	17	33	0
Technical information (e.g., informative pamphlets)	33	50	29	43	20	57	60	17	0	0
DEC/hwy. dept. cooperative control effort	28	25	29	36	20	14	0	42	33	33
In-service damage control training for crews	17	0	29	7	20	0	20	42	0	0
On-site advice for control device installation	30	0	43	31	20	29	20	50	0	0
Technical assistance with road/structure design modification	33	25	57	43	40	29	0	33	0	33

[1]Multiple responses (percentages are rounded to nearest whole number).

Table F-9. Damage Tolerance Attitudes of Highway Superintendents Reporting Beaver Damage by County.

Damage Attitude	Percent of Superintendents									
	All Counties (N=58)	Broome (N=4)	Cayuga (N=8)	Chenango (N=14)	Cortland (N=4)	Madison (N=8)	Onondaga (N=4)	Oswego (N=12)	Tioga (N=3)	Tompkins (N=1)
The damage that beavers cause to roads and other structures is:										
Tolerable	64	50	38	93	75	75	75	42	33	100
Unreasonable	36	50	62	7	25	25	25	58	67	0
Totals	100	100	100	100	100	100	100	100	100	100

Table F-10. 1982-1984 Trend in Beaver Damage Problems Perceived by Highway Superintendents.

Problem Trend	Percent of Superintendents									
	All Counties (N=122)	Broome (N=14)	Cayuga (N=17)	Chenango (N=18)	Cortland (N=12)	Madison (N=15)	Onondaga (N=13)	Oswego (N=19)	Tioga (N=7)	Tompkins (N=7)
Increasing	41	29	41	45	42	33	31	69	43	14
Stable	41	43	47	33	33	67	46	16	57	43
Decreasing	5	0	0	11	17	0	0	5	0	14
Unknown	13	29	12	11	8	0	23	10	0	29
Totals	100	100	100	100	100	100	100	100	100	100

Table F-11. Future Beaver Population Trends Preferred by Highway Superintendents in Region 7.

Preferred Trend	Percent of Superintendents									
	All Counties (N=121)	Broome (N=14)	Cayuga (N=16)	Chenango (N=20)	Cortland (N=12)	Madison (N=14	Onondaga (N=13)	Oswego (N=18)	Tioga (N=7)	Tompkins (N=7)
Greatly increase	3	0	0	10	8	0	0	6	0	0
Moderately increase	5	0	0	10	8	7	15	0	0	0
Slightly increase	3	0	6	5	0	0	8	0	14	0
Maintain same	44	79	25	45	43	29	46	33	43	72
Slightly decrease	14	0	19	20	8	36	15	6	0	14
Moderately decrease	12	14	12	10	8	14	8	11	14	14
Greatly decrease	19	7	38	0	25	14	8	44	29	0
Totals	100	100	100	100	100	100	100	100	100	100

Table F-12. Relationship Between the Number of Beaver Damage Sites Experienced and Highway Superintendents' Population Trend Preference.

Preferred Trend[1]	Percent by Number of Beaver Damage Sites			X^2*
	0 (N=58)	1-3 (N=40)	4+ (N=17)	
Increase	19.0	7.5	0.0	
Maintain same	60.3	30.0	17.6	
Decrease	20.7	62.5	82.4	
Totals	100.0	100.0	100.0	28.89

[1]Responses for "slightly," "moderately," and "greatly," were combined for both "increase" response options as well as "decrease" response options to form single categories.

*Chi square test: degrees of freedom = 4; $P \leq 0.05$.

Table F-13. Highway Superintendents' Tolerance of Beaver Located Within Their Town.

Tolerance Attitude	Percent of Superintendents									
	All Counties (N=119)	Broome (N=14)	Cayuga (N=17)	Chenango (N=18)	Cortland (N=13)	Madison (N=13)	Onondaga (N=13)	Oswego (N=18)	Tioga (N=6)	Tompkins (N=7)
Most problems that beaver cause are tolerable because I enjoy having them around	29	36	12	55	38	15	23	22	33	29
It does not matter whether beaver are in my town or not	13	21	18	6	8	15	15	6	0	29
I can enjoy a few beaver, but I worry about them causing damage	43	43	35	28	46	55	47	50	50	42
I generally think of beaver as a nuisance; I could get along without any beaver	15	0	35	11	8	15	15	22	17	0
Totals	100	100	100	100	100	100	100	100	100	100

Table F-14. Overall Relationship Between Highway Superintendents' Tolerance of Beaver Within Their Town and Their Preferences for Beaver Population Levels.

	Percent			
Population Preference	Enjoy Beaver (N=34)	Presence Doesn't Matter (N=14)	Worry About Beaver (N=50)	Beaver Are Nuisance (N=17)
Increase	32.4	0.0	4.0	0.0
Maintain same	58.8	71.4	32.0	17.6
Decrease	8.8	28.6	64.0	82.4
Totals	100.0	100.0	100.0	100.0

Table F-15. Differences In Beliefs Affecting Attitudes About Beaver Among Highway Superintendents Tolerating Beaver In Their Town vs. Those Who are Intolerant.

Belief Statements	Mean Belief Score ($\bar{y}$)[1]				Significance[2]		
	Tolerant		Intolerant				
	N	$\bar{y}$	N	$\bar{y}$	t	d.f.	p
Noneconomic/nonextractive-use beliefs							
I do/would like to talk about beavers with family or friends	47	2.2	62	2.6	2.13	109	0.006
I do/would enjoy observing or photographing beavers	46	2.0	62	2.7	3.78	106	0.027
I consider the presence of beavers to be a sign of the quality of the natural environment	49	1.8	65	2.3	3.56	112	0.005
I do/would express my opinions about beaver and their management to public officials or to officers of private conservation organizations	46	2.2	61	2.2	0.08	105	0.557
I enjoy knowing that beavers exist in nature	48	1.6	64	2.1	3.74	110	0.000
I appreciate the role that beaver play in the natural environment	48	1.8	65	2.5	4.43	111	0.000
I enjoy beaver for their educational value; they teach us more about nature	50	2.0	65	2.6	4.23	113	0.002
I do/would like to understand the reasons that beaver behave as they do	48	2.3	65	2.3	0.10	111	0.141

[1]Belief scores range from 1 to 5 where 1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = strongly disagree.

[2]Student's t test: Test for statistical difference between ($\bar{y}$) tolerant and ($\bar{y}$) intolerant with 95% level of confidence.

Table F-15 (continued)

Belief Statements	Mean Belief Score ($\bar{y}$)[1] Tolerant N	Tolerant $\bar{y}$	Intolerant N	Intolerant $\bar{y}$	Significance[2] t	d.f.	p
Noneconomic/nonextractive-use beliefs							
I think that the wetland areas created by beaver are important to the natural environment	50	1.8	64	2.9	6.22	112	0.000
Economic/extractive-use beliefs							
I do/would enjoy trapping beavers for the sale of furs or pelts	47	3.7	61	3.4	1.27	106	0.568
I think it is important to manage beaver for an annual harvest for human use without harming the future of the beaver population	49	2.3	64	2.5	0.83	111	0.428
I think that local economies should benefit from the sale of equipment, supplies, or services related to trapping of beaver	48	3.0	62	2.8	0.86	108	0.944
Problem-tolerance beliefs							
I can/could tolerate most beaver nuisance problems	49	2.1	61	3.2	6.28	108	0.001
I can/could tolerate most levels of property damage by beaver	45	2.4	60	3.3	4.41	103	0.019
I can/could tolerate the ordinary risk of beaver transmitting disease to humans or domestic animals	48	2.4	63	3.3	4.66	109	0.199

[1]Belief scores range from 1 to 5 where 1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = strongly disagree.

[2]Student's t test: Test for statistical difference between ($\bar{y}$) tolerant and ($\bar{y}$) intolerant with 95% level of confidence.